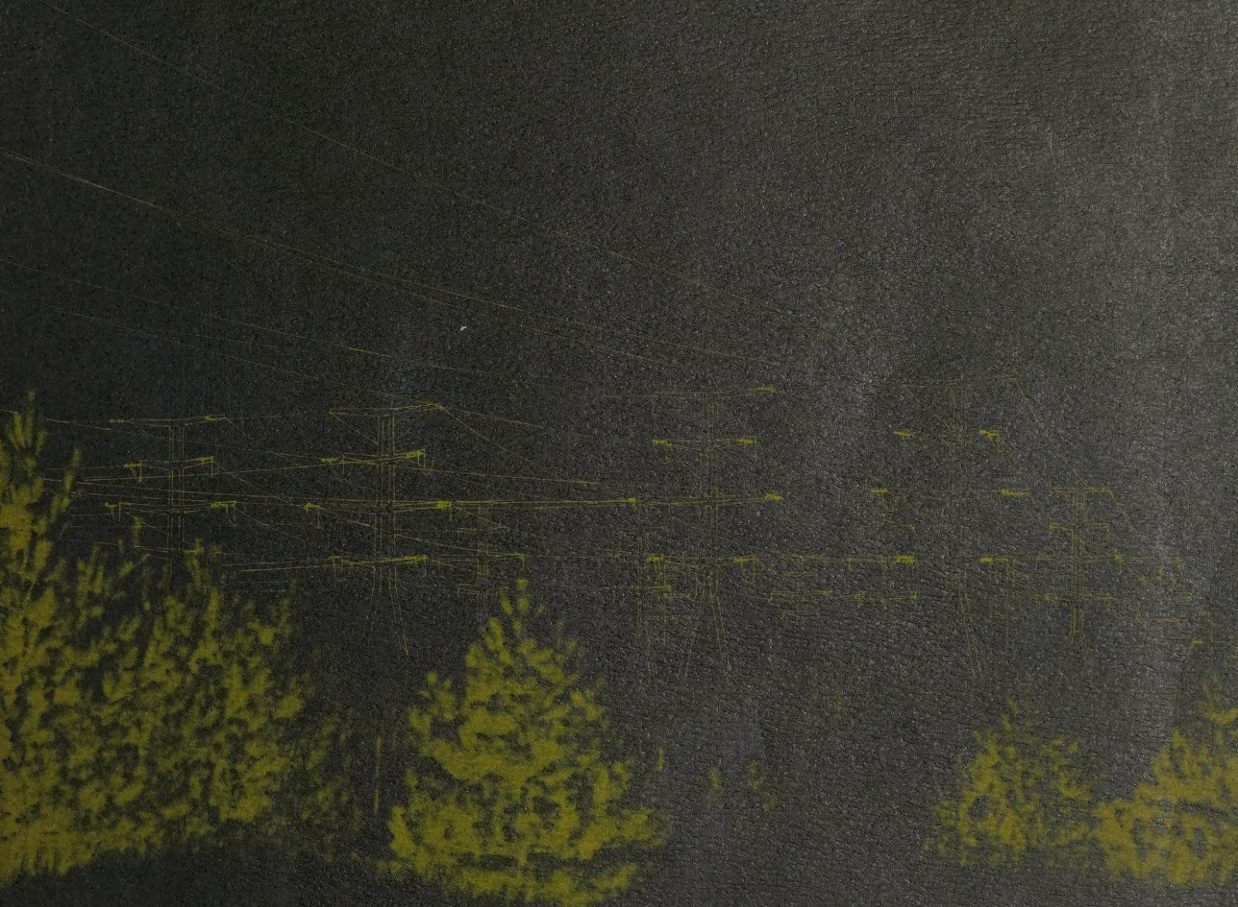


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Report of the Solandt Commission



"Closing the Generation Gap"

A public inquiry
into the
transmission of power
between
Nanticoke and Pickering



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Toronto Ontario

March 1974



The Honourable Allan Grossman,
Provincial Secretary
for Resources Development,
The Government of Ontario.

Dear Mr. Grossman:

As a Commissioner of Inquiry, appointed by Orders-in-Council OC-2053/72, dated the 21st day of June, A.D. 1972, and OC-2947/72, dated the 13th day of September, A.D. 1972, pursuant to the provisions of The Public Inquiries Act, 1971, to inquire into and make recommendations on the transmission of power between Nanticoke and Pickering, I am pleased to submit to you the following Report of the Commission.

Yours sincerely,

Omond Solandt

Omond M. Solandt,
Commissioner.



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Report of the Solandt Commission

A public inquiry into the transmission of power
between Nanticoke and Pickering

March 1974

Preface

The role of the Commission has been to provide a forum for a lively discussion between Ontario Hydro, who must build new transmission lines to serve the public, who have their own diverse views as to how and where transmission lines should be built, and Bhi Limited, who have collected, portrayed and analysed much of the factual basis for decision making. It has been an interesting and rewarding experience. There are no unique answers to complex social questions of this kind. No two people will agree on what is the best solution; therefore, I will not claim that the Commission has achieved perfection. I do believe, however, that the combined efforts of all concerned have come together in a recommendation that is very much better than the earlier ones and that it will be much more readily accepted by everyone, even those who are adversely affected by it, because they know that their views have been heard and considered.

Summary of Principal Recommendations

1. The Recommended Route

The recommended route is shown in detail on Map #1 (at the back of this report). The route proceeds north from the Middleport Station, through the Beverly Swamp on the right-of-way presently owned by Ontario Hydro. It then crosses to the north side of Highway 401 and thence eastward to a transformer station near Milton. Just before reaching the Milton Station this east-west route is joined by the lines from the Bruce Generating Station, to the north, that cross the Niagara Escarpment at Limehouse. From the Milton Station there is a southward link to the Halton Station, while the main route proceeds eastward south of Brampton and north of the airport to Woodbridge, thence eastward across Yonge Street to a new Parkway Station and thence to a point south of Markham. The route will follow the "Parkway Belt: West" from Milton to south of Markham. From there to the Cherrywood Station a route has been selected but this section of the line should, if possible, be included in the "Parkway Belt: East" when it is designed.

2. Transmission Tower Design

Single shaft, "improved appearance" towers are to be used throughout the recommended route, except in the section from Middleport Station to Highway 401 through the Beverly Swamp, where lattice towers are proposed for use.

3. Underground Transmission

The Commission concludes that 500 kV underground cable is not at present an attractive alternative and that neither the cost nor the security risk are justified by the improvement in environmental impact that would be achieved.

4. Urgency

The proceedings of the Commission have already seriously delayed the construction of the transmission line. Further delays should be minimized by

the following actions:

- a) The hearings of the Solandt Commission should be accepted as adequate public exposure of Ontario Hydro's plans and adequate justification of the need for the line and, therefore, the 'hearings of necessity', required by The Expropriations Act, should be waived in those cases where the acquisition of property by expropriation is required.
- b) While it is a complex legal problem beyond the terms of reference of this Commission, the Commission recommends that any exemptions to The Planning and Development Act that will help to speed up the fair and orderly acquisition of land for this route should in this case be granted to Ontario Hydro.
- c) In order to obtain the earliest possible approval for the construction of the lines from the Bruce Generating Station to a new Milton Station and on to a new Halton Station, the Commission recommends that, if possible, the public hearings on those sections of the Parkway Belt which include this part of the route for the 500 kV line, should proceed even before all the "Parkway Belt: West" planning is complete.

5. A General Data Base for Land Use Planning

There is an urgent need for the centralization of all the data needed for land-use planning and control, so organised as to provide information not only to government agencies but also to the public.

Acknowledgements

The Commissioner's task has been a fascinating, if at times arduous and I would like to give my most sincere thanks to all those who helped to get me involved in the task and to those who helped me to carry it through to completion.

I would like to thank, first, the Premier of Ontario, The Honourable William G. Davis, who asked me to take on the job, The Honourable A.B.R. Lawrence, the former Provincial Secretary for Resources Development, who got me started and was continually helpful and the Deputy Secretary, Dr. J.K. Reynolds, who found the staff and assistance that I needed, guided me through the intricacies of government organization, and provided wise and friendly advice on many occasions.

It seems almost presumptuous to thank the staff for their work because they have been just as much a part of the Commission as I myself. James Shantora as the first Secretary, organized the work of the Commission, saw it through the first series of hearings and has remained throughout as Commission Counsel. His place as Secretary was taken by Neil Cole, who has guided the Commission through the second set of hearings and the publication of this report. Linda White has done the administrative work for the Commission's hearings and the report and run the office with the able assistance of Paulette Apostolov.

In a sense, the Commission acted as "bystanders", watching and recording the interaction between two opposing groups who were seeking a mutually satisfactory solution to a common problem. These were, on the one hand, Ontario Hydro and, on the other, the organizations of concerned citizens, the environmental groups, the municipalities, other organizations and just plain people. It is obviously impossible to thank them all and dangerous to thank a selected few. However, I will run this risk and hope that any who are not named will, nonetheless, feel that I am fully aware of their contribution and grateful to them personally for it.

Mr. George E. Gathercole, Chairman of the Hydro-Electric Power Commission of Ontario, took an active personal interest in the proceedings, appeared at several of the early hearings and generally set a friendly and positive tone for all the proceedings. Mr. James Southey, Q.C., counsel for Ontario Hydro at the later hearings, continued this role and gave to those hearings an orderly informality that was most effective. Mr. John P. Dobson, Manager of Property Planning, Ontario Hydro, acted as liaison officer between Ontario Hydro and the Commission throughout. His encyclopaedic knowledge and continual willingness to help made an immense contribution to the success of the venture. Mr. Neil McMurtrie, Director, Property Division, Ontario Hydro, never hesitated to join in the discussion and always had the answers available. Mr. Jack Winters, Chief Forester, Ontario Hydro, successfully convinced a skeptical audience that Ontario Hydro could plant trees as well as cut them down.

To name all the others from Ontario Hydro who contributed effectively to the work of the Commission would occupy many pages. So, rather than do this, I will thank them collectively. They did a great job, not only as employees of Ontario Hydro but also as informed and intelligent citizens helping to find the right answer.

Mr. R.D. Dillon, newly appointed Deputy Minister of Energy, played a key role in coordinating the response of government ministries to the work of the Commission.

Among the various groups, Mr. Lee Symmes of the Coalition of Concerned Citizens deserves special mention. Had there been marks for attendance, he would have led the class, not only in attending nearly every session of the hearings but in making his presence felt by well prepared briefs and incisive cross-examination. Others who made a major contribution in this way were: Mrs. Margaret Britnell, Concerned Citizens of King Township; Messrs. Greg Cooper and Bruce MacOdrum, The Sierra Club of Ontario; Mr. Paul Chester, East Flamboro Citizens' Committee; Mr. R.L. Duke, Dundas, Ontario; Mr. Gordon Kidd, Halton Federation

of Agriculture and Mr. John Schneider, Interested Citizens of North Halton and Wellington

The municipalities made a major contribution to the work of the Commission. This was often done by the senior elected official or by councillors and sometimes by the clerk, planning officer or other members of the municipal staff. The distinctive contribution of the municipalities was their detailed knowledge of local conditions and of past and potential land usages and zoning; their written briefs were of high standard and their cross-examination of witnesses concise and effective.

Throughout this report, there are various favourable comments on the work of Mr. Bruce Howlett and the staff of Bhi Ltd., the environmental consultants to the Commission. They all played such an important part in the work of the Commission that they each deserve to be named in order to receive special thanks. Tom Sparling, Gail Ferguson and Ray Essiambre have been with Bhi throughout the entire study and the recent public hearings; Judith Duncan and Derek Kaye served with Bhi to the end of the study.

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INTRODUCTION

The Task, The Commission, The Initial Hearings

The Hydro-Electric Power Commission of Ontario¹ has been successfully meeting the requirements of the citizens of Ontario for electric power since its foundation more than 68 years ago. It is now among the world's largest utilities and has established an enviable reputation for reliability, low cost, widespread distribution of power and for remaining abreast of modern technology. Power requirements are doubling every 10 to 12 years. Ontario Hydro presented evidence before the Commission indicating that this trend is likely to continue for the foreseeable future and that the system must be constantly expanding to meet this growing demand. The economies of scale in power plants are so important that, as the system grew, the individual generating stations became larger and, consequently, the steps in this expansion became bigger and more obvious to the public. At present there are four major new generating stations in various stages on completion: the Pickering Nuclear Plant with four operating units just completed; the Nanticoke Coal-fired Plant, located on Lake Erie south of Hamilton, with three units in service and five more under construction; the Lennox Oil-fired Plant, on Lake Ontario between Kingston and Belleville, in the late stages of construction; and the Bruce Nuclear Plant, on Lake Huron at Douglas Point near the town of Kincardine, the construction of which is well underway.

Ontario Hydro has for many years envisaged a continuing need for increased transmission facilities in the Toronto area and, recognizing the particular need for a new major east-west transmission line, has watched the northward growth of the city with great concern. Early conceptual planning for this east-west link began when the 500 kV² line from Sudbury to Kleinburg was planned in 1962. When land was purchased for the Nanticoke Generating Station in 1966, the need for a link from Nanticoke to Pickering was definitely established. Although the specific need for the line was established by the construction of generating stations at Nanticoke and Pickering, it is misleading to call it "the Nanticoke to Pickering Transmission Line" since the purpose of the line is not to transmit power

¹ Incorporated March 4, 1974 as Ontario Hydro

² kV = kilovolts = thousand volts. 500 kV = 500,000 volts

from Nanticoke to Pickering or the reverse but rather to connect the main load centres of southern Ontario, which extend along the lakefront and include Metropolitan Toronto, to the Nanticoke Generating Station to the south-west, the Bruce Generating Station to the north-west and the Pickering and the Lennox Generating Stations to the east. The line also serves to provide major transfer capacity between the eastern and western portions of Ontario Hydro's southern transmission network.

In their earlier planning, Ontario Hydro considered four possible routes for this line: north, middle, south and parkway. The following quotation from Ontario Hydro's Submission aptly summarizes them.

The Middle Route, considered best by Hydro, crosses the Niagara Escarpment north of Boston Mills, passes north of Bolton, crosses highway 11 between Newmarket and Aurora, and follows a Highway 404 alignment to the Parkway Belt³, then travels either south or north of the proposed airport in Pickering Township. (...)

A North Route, traversing the Escarpment in the Mono Mills area and crossing Highway 400 north of the Holland Marsh and Highway 11 between Bradford and Newmarket, was examined but found to be much less desirable than the Middle Route.

A South Route, which crosses the Escarpment north of Speyside, passes south of Georgetown, north of Brampton, and follows a course past Kleinburg and across Highway 11 between Oak Ridges and Richmond Hill, was also considered. It was found to be more disruptive than the Middle Route because a larger number of buildings would be affected and more people would be dislocated. It would also create a second artificial severance barrier near the Parkway Belt in Vaughan and Markham Townships.

A fourth route along the proposed Parkway Belt traverses more highly urbanized land, is too narrow in sections, and with the addition of high voltage lines would cause even more dislocation to people and property.⁴

Having selected the "Middle Route", Ontario Hydro initiated discussions about it with the municipalities concerned. To quote again from Ontario Hydro's Submission:

3 The Parkway Belt here referred to was first publicly proposed and described in general terms in the Toronto-Centred Region Plan, 1970.

4 Submission of Ontario Hydro to the Solandt Commission July 31, 1972, p. 5

During the last three years Ontario Hydro has held many discussions concerning the overall Nanticoke to Pickering route with municipal and conservation authorities, provincial government agencies, and groups of involved citizens. Six of the nine municipalities in the section of line dealt with in this submission between Puslinch Township and Whitchurch-Stouffville have agreed that the Middle Route does not conflict with planned development. One has left the decision to Hydro, one has asked for more information, and one has so far declined comment.⁵

In spite of this substantial acquiescence by the municipalities, strong opposition to the line remained in 1972. This was expressed particularly by the Coalition of Concerned Citizens who presented to the Premier of Ontario a petition which was supported by the Sierra Club and the Conservation Council of Ontario. After hearing their representations, the Premier decided to establish a Commission under The Public Inquiries Act to investigate the problem. By Order-in-Council OC-2053/72 dated June 21st, 1972, I was appointed under the provisions of The Public Inquiries Act, 1971, "to inquire into the transmission of power from Nanticoke to Pickering and to make recommendations thereon for the information and consideration of the Provincial Secretary for Resources Development on or before the 15th day of September, 1972". A later Order-in-Council removed this restrictive date.

The Commission held a series of public hearings in August and September, 1972, during which Ontario Hydro presented the case for their preferred route and were cross-examined on it by representatives of municipal governments, groups and associations, and by private individuals. These in turn had an opportunity to present their own views before the Commission. Expert witnesses were also called in certain cases, to testify before the Commission. The discussion during the hearings was not restricted to the primary questions of route selection. Argument extended from the broad issues of energy consumption and the conservation of resources, to the particular use by Ontario Hydro of herbicides and pesticides in their maintenance of the transmission rights-of-way.

5 Ibid., p.5

The Commission's Interim Report

On conclusion of the hearings, I submitted a report to the Government, on October 31st, 1972, in which I stated that, while the need for the lines had been proven and the choice of 500 kV as the appropriate transmission voltage has been substantiated, insufficient evidence had been presented for me to determine that any of Ontario Hydro's proposed alternatives was the best available route.

In the report, I stated that:

The discussion left the impression that the broad study of the whole area had been rather superficial and that attention had been focused on the Middle Route alone quite early in the analysis. As a result the main effort had been devoted to studying the details of the Middle Route. Equally detailed studies of the alternative routes were not available for comparison, nor was there convincing evidence that any one of the three routes studied was the route of minimum environmental impact.⁶

For these reasons, I recommended that Ontario Hydro's already extensive study should be supplemented by a much more widespread and systematic study of the entire area which might be traversed by the transmission line, in order to determine the best possible route.

At the same time, I recommended that participation by the public should be sought from the outset of such a study, so that the special characteristics of the area and the concerns of its citizens would be part of the study's considerations.

Before continuing this narrative, it would seem appropriate to pause here, briefly to describe the character of the study area and of its population.

The Commission's Area of Inquiry: A Perspective

In recommending a further study, the Commission did not wish to ignore Ontario Hydro's recommendations, nor did it want merely to do a study centred around Ontario Hydro's "Middle Route". Accordingly, it was

6 The Solandt Commission Interim Report October 31st, 1972, p.16

decided that a study broad enough to include all possible routes was required. As a result the area involved, being that area within which the Nanticoke - Pickering transmission line might feasibly be routed, is relatively large. Bhi Limited⁷, the environmental consulting firm retained to do the study, selected in consultation with the Commission an area of some 3,700 square miles within a boundary line drawn from Nanticoke north to Middleport (south-west of Hamilton), extending northerly through Guelph, then beyond Orangeville, north of Bradford, through the southern end of Lake Simcoe and on to Port Perry on Lake Scugog, then south to Lake Ontario slightly east of Oshawa. This is shown in Figure I.

This broad area includes urban, suburban and farming areas and a variety of natural landscapes and so includes the present zone of transition between urban and rural land uses.

The closely built-up urban belt along the lakeshore, extending east and west from Metropolitan Toronto, precludes consideration of a major transmission corridor near the shoreline. (Several members of the public suggested routes along the shoreline, off-shore, or in deep waters of Lake Ontario. If the primary purpose of the line were to connect the two generating stations of Nanticoke and Pickering, then this would be a possibility well worth considering. However, since the line is primarily to connect the two power plants with many load centres north of the lake, the number of dropouts required would make a submarine cable an extremely expensive and complex alternative.)

Immediately adjacent to the urban belt is the large agricultural hinterland around Metropolitan Toronto, comprising much of the Counties of Halton, Peel, York and Ontario. It provides a fine rural landscape at once capable of high agricultural production and close to the growing population centres of southern Ontario.

Moving away from the heavily developed lakeside cities and towns, one finds isolated pockets of suburban development within this agricultural hinterland, together with a pattern of urban strip development along the major roads of many rural and suburban areas.

⁷ Hereafter referred to as Bhi.

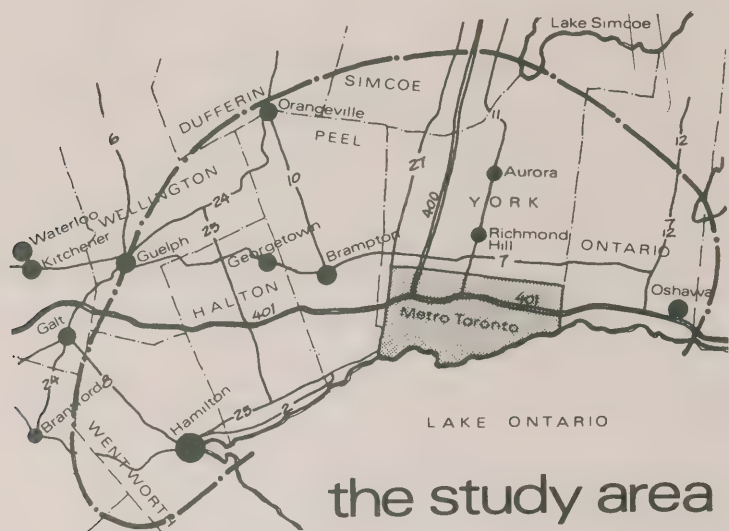


Figure 1

Further north, the natural environment becomes more obvious. The physiography gradually changes into gently rolling hills, vegetation density increases from tiny farm woodlots to major forests and plantations. Here, the man-made features consist of original farmsteads and an increasing number of rural estate developments.

Along the western edge of the study area, the major presence of the Niagara Escarpment stretches from Hamilton north to Orangeville, where it merges with the Oak Ridges Moraine in the Caledon and Albion Hills.

The steep rock face of the Niagara Escarpment, a primary natural feature in the landscape of southern Ontario, provides a significant obstacle to the routing of an east-west transmission corridor. The Bruce Trail, which traverses the whole length of the Escarpment, is one of the principal means whereby the public can enjoy the wealth of forests, cliffs, hills, waterfalls, scenic viewpoints, unusual rock formations, and interesting plant and animal life which the Escarpment affords.

To the north and east, the Oak Ridges Moraine, made up of densely wooded rolling hills, interspersed with small lakes and wetlands, offers a further scenic, recreational and rural landscape.

Taken together, the features of the potential study area afford a variety both of land forms and usages. There is a similarly remarkable diversity in the area's population.

The variety of divergent views on the increasing complexities of present and future land use is large. On the one hand, there is the urban and suburban dweller whose attention has in the past been concentrated almost wholly on the city but who now, with increasing opportunities of leisure and transportation, turns to the country for recreation. On the other, there is the traditional working farmer, increasingly caught between the attractions of continuing to operate his farm and the financial rewards and pressures of nearby urban and suburban development. Finally, there is the relatively new phenomenon of the "rural estate owner" who, while working in the city, has chosen to live in the country because of its relatively undisturbed natural environment.

The Bhi Study

To resume the narrative of events. The Government very quickly accepted the recommendations of my Interim Report and asked me to retain a consultant to do the proposed study. During the earlier proceedings of the Commission, many consultants had offered their services. An additional search was made to see if there were any uniquely qualified consultants that had been overlooked. This brief but active survey strongly suggested that we should choose Mr. Bruce Howlett. He has excellent qualifications, an established professional reputation for high quality studies on the environmental impact of electric power transmission lines, had created an excellent impression on all who heard him at the Commission hearings, was already quite familiar with the problems to be studied and was available to begin work quickly. As a result, Mr. Howlett and his new formed Toronto firm, Bhi Limited, were retained on November 15th, 1972, to undertake the study.

The terms of reference for the Bhi study are concisely defined in a letter from the Solandt Commission to The Honourable A.B.R. Lawrence, Q.C., then Provincial Secretary for Resources Development:

The object of the study is to provide advice to the Commission on the best available route for a 500 kV line from Middleport to Pickering. In making the route selection the primary emphasis must be given to environmental factors in key areas such as the crossing of the Niagara Escarpment. In other areas the balance will be different but in all cases the environmental, social and economic factors must be considered. The aim is not to choose what is theoretically the best route but to choose a good route along which the line can be built quickly with the minimum of environmental damage and of local opposition. The study should also consider whether it is advisable to have five lines abreast and, if so, whether they should be included in a larger joint use utility corridor or whether it would be wiser to distribute the lines between two or more corridors.

I would propose that Mr. Howlett and members of the Hydro staff working with him should begin to involve the public as early as possible. Long before any recommended routes are available for discussion it should be possible to involve the public in deciding on the factors that need to be considered in choosing the line and the weight to be attached to them. My Commission might be used as a medium for arranging suitable meetings.⁸

The scope and nature of the study that would be required to satisfy these terms of reference was determined during discussions between Mr. Howlett and the Commission. Since Ontario Hydro's work would be at a standstill during any study that was made, it was obvious that speed was essential. If the study was to be done quickly and with acceptable public participation, it was obvious that the study methods must be relatively simple. Bhi chose, with the full support of the Commission, to use the well established and widely accepted technique of map overlays for identifying environmentally acceptable routes. The method consists in making very detailed inventories of all relevant and available information. This information is then transferred to maps. In this study the base maps were at a scale of 1:50,000. Transparent overlays with data on present land

⁸ Letter dated October 31st, 1972. Contained in the Interim Report of the Solandt Commission.

use, natural resources, critical natural features, scenic quality and land elevation are then placed over the base maps. These transparent overlays can then be put together in various combinations and viewed simultaneously, against the background of the base maps, in order to see areas where there is the least interference with any combination of the factors that are being evaluated. A further refinement of this method is to give different factors different weights and to express these weights visually as shades of grey. The darker the shade, the greater the importance attached to having the transmission line route avoid the area. When these shaded overlays are put over the map, routes that should be considered show up as clear or relatively light grey tracks.

The basic problem in using this method is to select a suitable area for analysis. If the area chosen is too large, much time will be wasted. If it is too small, desirable alternative routes may be missed. The area that was selected to meet these criteria has already been described on page 4.

In this case the route to be selected is not only to serve as a connection between two generating stations but must also provide for major transfer of energy in both directions between different parts of the system and connect with existing and future lower voltage distribution systems. In many cases the location of these connections is already fixed and tends to constrain new route selection.

In this case, the fixed points were: at the southwestern end of the line, not the Nanticoke Generating Station but rather the Middleport Station, approximately 25 miles north of Nanticoke from which Ontario Hydro had already located and bought a right-of-way; at the east end of the line, not the Pickering Generating Station but rather the Cherrywood Station, approximately four miles northwest of Pickering, again because the intervening right-of-way already exists. In between the Middleport and Cherrywood Stations, interconnections are required, first, with a transmission line coming south from the Bruce Generating Station and, second, to the 230 kV distribution at three points: Halton, Woodbridge or Kleinburg and Parkway Stations. The location of all of these is more or less fixed by the need to relate to existing installations.

Ontario Hydro gave Bhi a series of systems diagrams which provided a selection of possible patterns for interconnection between these already determined features of the system. These are described in some detail in the Bhi Report and will not be repeated here. The process of selecting routes then consisted, first, of identifying lines along which these connections might be placed with acceptable environmental effects. These elements were then grouped together into a series of alternate routes, each corresponding to one or more of the systems options defined by Ontario Hydro. At this stage, Bhi identified and described routes corresponding to four alternative systems: "Q:", "R", "S" and "T". None of these routes compare exactly with any of Ontario Hydro's earlier routes, though there are common elements between several of them. These alternatives were then presented to the public for their views before Bhi made their final selection.

Public Meetings

Bhi began to involve the public from the very beginning of their studies. Even the study method was selected to facilitate public involvement. Most people can understand and work with maps, but many are intimidated by computer printouts.

The first series of local public meetings which was held from February 19th to 22nd, 1973, at four locations served to acquaint people with the study methods and to ask for their participation. A second series of local public meetings was held from March 26th to 29th, 1973, again at four locations, at which the nine large scale inventory maps were presented for comment. At the third series of meetings, held in ten locations from June 28th to July 13th, 1973, minimum-impact alternative routes were presented with an invitation to people to express their preferences on maps and questionnaires. In addition, Bhi held special meetings for representatives of all municipalities in the study area, as well as holding monthly meetings at Queen's Park, Toronto, with representatives of provincial government agencies.

The pattern of contact with the public and of public meetings, which is

described in Bhi's subsequent report on their study, was arrived at after a good deal of discussion. It was obvious even in the planning stage that the time available would limit the extent of public participation. It was also evident that the publicity required to achieve extensive participation would be very expensive. On balance, the Commission feels that Bhi got very good value for the money spent on public participation and that little, if any, more could have been wisely spent in the time available. However, on future occasions, when more time is available, the possibility of encouraging even more widespread public participation should be considered and is discussed in a later section.

On several occasions during the hearings, the Commission and more specifically Bhi were criticized for not having done a formal cost benefit analysis of the various alternative routes. There is no doubt that a thorough and competent cost benefit analysis would have been of some assistance to the Commission but it would have been expensive and time-consuming and would certainly not have produced a unique and optimum solution to the problem.

While many of the variables involved in selecting the best route for a transmission line are quantifiable, many of the most important ones are not. They can be evaluated only by subjective judgments. In such circumstances even the best cost benefit analysis merely gives the analysts some feel as to which variables are important and which can be disregarded. Even this result can only be achieved by a time-consuming and expensive iterative process during which a wide range of values are attached to the unquantifiable variables. This process has very real dangers since, if the values selected for trial do not fall within the limits of the real life situation, the final result obtained may be far removed from the optimum that is being sought. Not infrequently the cost benefit analyst chooses to ignore variables that he cannot quantify. This practice is obviously even more dangerous and has done much to discredit cost benefit analysis among thoughtful people.

The Commissioner, therefore, decided not to recommend a formal cost benefit analysis in this study. Bhi concurred in this judgment and did not press for the inclusion of a cost benefit analysis in their study.

Obviously both the Bhi staff and the Commissioner have kept cost benefit ratios constantly in mind during their consideration of the alternative routes but, for the reasons outlined above, no formal cost benefit analysis was included in the study.

The task of writing such a report as this immediately throws a spotlight on the depth, quality and completeness of the study on which it is based. The Bhi report stands up well to this close inspection. To produce any substantial improvement on it would have required a much longer time, a larger staff and several times as many dollars. The Commission feels that this would not have been worthwhile. The very detailed studies that would result are probably best done in this case by Ontario Hydro and to some extent by the Parkway Belt planners. Had the Bhi study gone into greater detail, it would probably have merely duplicated this later work.

The Commission is extremely well satisfied with the work of Bhi. Mr. Howlett is an experienced professional in his field. He quickly assembled a strong support team, mainly Canadian but backed up by more experienced consultants in the United States, which collected the necessary factual material with incredible speed. The industry of the group had to be seen to be believed. They literally worked nights, Sundays and holidays.

The Bhi Report

Following the last series of public meetings and after receiving final public comments on the alternatives that had been presented to them, Bhi made their final selection of a route. The Bhi Report was submitted to me at a press conference held at Queen's Park, Toronto, on September 13th, 1973. The Commission's hearings to provide an

opportunity for public examination and discussion of this recommendation began on October 15th, 1973 and concluded on December 6th, 1973. Since the route that is recommended to the Government in this report has been selected from the routes that Bhi recommended to the Commission, it is useful to outline briefly the Bhi recommendations. Anyone wishing to study these in complete detail should refer to the original report.⁹

The main conclusions of the Bhi Report are contained in the following quotation from it:

The Preferred Route

The Preferred Route is the Parkway Route. It is the shortest, has a comparatively low environmental impact, has fewer substations than the northerly alternate, is possibly the cheapest in overall cost, conforms to Provincial plans for future utility corridors, and is widely accepted by the public, by several Provincial agencies and local governments, and by a number of citizen groups.

The disadvantages of the Parkway route are higher costs for more "improved appearance" towers, possible higher costs for land, and the possibility of delay if the Government does not act expeditiously to permit Hydro to buy land in the Parkway Belt.

Route Description*

From west to east, the preferred route can be broken into three segments: (1) from the Bruce and Nanticoke power plants across the Niagara Escarpment to Halton substation, (2) from Halton through Woodbridge and Parkway to Cherrywood substation, (3) connections to the north from Woodbridge and Parkway substations.

- * "The preferred route is denoted as "Modified Route Q" and is identical to "Route R", except for the double crossing of the Escarpment described in the text."

Bruce and Nanticoke Stations to Halton

Power from two generation stations, Nanticoke on

⁹ An Environmental Study to select Hydro Transmission Corridors for the Solandt Commission, September 13th, 1973, p. 43-56

Lake Erie and Bruce on Lake Huron, must flow to a Halton substation located southeast of Milton. Three ways were explored for making this connection.

First Option (Modified Q)

The most southerly option is the preferred option and would require two crossings of the Escarpment, one south of Rattlesnake Point and the other via Highway 401.

The impact of these two crossings would not be the same. South of Rattlesnake Point, three 500 kV circuits are required; one in 1976, another in 1982, and a third not until 1990. The first two circuits could be carried on one tower alone. However, because of the visual sensitivity of this area, and taking into account the rapid advances being made in technology, it is recommended that for the portion crossing the Escarpment between Kilbride and Highway 25, that only a low, single pole, single circuit (preferably compact) tower be erected for the 1976 line, and that when the 1982 line is required, the overhead line be removed and both lines be placed underground using Hydro's DAMUT¹⁰ system or conventional underground cable. If this recommendation is followed there would be no permanent overhead lines on this Escarpment crossing. When the 1990 line is required, it too should be placed underground in this area. (...)

At the 401 crossing more lines are required than for the Rattlesnake crossing. Two double circuit 500 kV lines would be needed in 1977 with another in 1980. Two double circuit 230 kV lines are also needed, with the date noted by Hydro as "indefinite". A crossing at this point also assumes that Hydro can find a location for this corridor to the west out of the study area to the south or east of Guelph. Hydro is presently studying this possibility.

This Escarpment crossing, following the common corridor concept is being located adjacent to Highway 401, presents a potential visual conflict for the place where the crossing must be made can be seen by people travelling along the 401. To

¹⁰ DAMUT - Ducted Air Medium Underground Transmission, a concept unique to Ontario Hydro consisting of three aluminum tube conductors in a large air-filled pipe. It is being actively developed for possible use at 230 kV but is still in the laboratory. Field tests of sections at 230 kV are planned for early in 1977.

reduce this conflict to the minimum, the Escarpment crossing has been located well to the north of Highway 401, angling across the Escarpment on a slope, thence through an area already scarred by a quarry, continuing to the west through scattered woodlands which aid in reducing visual impact. (...)

For that portion of the route west of the Escarpment along Highway 401, it is recommended that the lines be located to the north of the highway for some distance so as to avoid residences, historic homesites and other developments that cluster on and near the north side of the road. In addition, the presence of existing trees and vegetation in this area will aid in concealing the view of the towers from the highway. (...)

Second Option (System Q)

The second option would also have two crossings of the Escarpment, one along Highway 401 and the other in the vicinity of Georgetown.

In this option, the Middleport line would continue north and across Highway 401, then turn east and run offset and parallel using existing trees for concealment, then cross the Escarpment in the same place and manner suggested under Option 1. In this case however, only one double circuit tower would be required, with one circuit strung in 1976 and the other in 1982. If this option is followed, it is recommended that where the line crosses the Escarpment, the same program be followed as in Option 1 for the Rattlesnake Point crossing. The 1976 line would be taken down and placed on or underground along with the 1982 line, as would the 1990 line.

In this area, in response to a number of requests, a re-study was made of the Beverly Swamp to ascertain whether another alignment through, or skirting the swamp would be feasible. Such an alignment was found. Many people felt the line should go through the swamp on the right-of-way already purchased by Hydro and thereby avoid other impacts. While this is a compelling argument, the impact on a scarce and sensitive natural resource must also be recognized.

If this option is selected, we recommend that Hydro, in conjunction with the Conservation Authorities Branch, Ministry of Natural Resources, undertake a biological survey of the area to determine the propriety of following the corridor through the swamp. If such a course of

action appears feasible, it is assumed that minimum disturbance would be necessary both in installation of the facility and future maintenance practices. Lattice structures would likely be desirable in such circumstances. If this routing is not desirable on environmental grounds, we recommend either the alternate set forth in this study, or that an alternate west of the swamp be followed.

Under Option 2, a connection would also be required from Halton north to the Bruce Station via Georgetown, consisting of three double circuit 500 kV lines and two double circuit 230 kV lines. Two of the 500 kV lines are required in 1979 with the third in 1980. The 230 kV lines are required much later, with the first slated for 1985 and the second for 1990 (essentially this is the same corridor that would cross the Escarpment along Highway 401 under the first option). North of 401, after proceeding through farmland, this corridor would then cross the Escarpment at a comparatively shallow location in the vicinity of Limehouse where extensive quarrying operations have already marred the landscape. The line would then continue north to the vicinity of Ballinafad. From here the best routing to the north will depend on location studies underway by Hydro to link to the Bruce generation station. (...)

Third Option (System R - rejected)

Although this option has been rejected, it is included to explain the attempt made to secure only one crossing of the Escarpment.

The least impact route to Halton would bring both corridors from Nanticoke and Bruce together for one crossing of the Niagara Escarpment along or near Highway 401, thence to the Milton-Halton area. However, this alternate has been rejected by Hydro as unacceptable. Hydro contends that if a disaster should occur on this joint corridor, all power from both stations would be lost. Hydro prefers to have both lines separated by at least five miles to avoid destruction from tornadoes and other natural catastrophes.

For these reasons, desirable though it may be environmentally, placing both corridors in one right-of-way does not appear to be feasible on cost and reliability grounds, and a choice must

be made from the other two alternatives. Of those, Option 1 is preferred for reasons of shorter line length, no visual impact on one crossing of the Escarpment (a temporary impact would occur between 1976 and 1982), more joint use of existing rights-of-way and reduced or no impact in areas parallel to the Escarpment to the north and south.¹¹

In the Bhi Report, the remainder of the route is described under the headings "Milton to Halton Station", "Halton Station to Woodbridge Station", "Woodbridge Station to Parkway Station", "Parkway Station to Cherrywood Station", "Woodbridge-Kleinburg and North" and "Parkway North". Since the route recommended by the Commission from the Milton Station to the Cherrywood Station is closely similar to that recommended by Bhi, the Bhi description of the route will not be repeated here. Those who are interested in comparing it with the Commission's recommendation should refer to the original Bhi Report, which also contains photomosaics of the recommended and alternative routes.

The Commission Hearings

After the Bhi Report had been received by the Commission, distributed to all those known to be interested and made available to the public generally, a period of four weeks was allowed for those interested to digest the report and make submissions to the Commission. The hearings re-opened on October 15th, 1973. During the sessions at Queen's Park, which concluded on December 6th, 1973, Mr. Howlett and his staff made a detailed presentation of their recommendations; this was followed by cross-examination and later by a wide variety of submissions, some of which were in turn subjected to cross-examination. The dates of all sessions of the Commission, including local public hearings, together with a list of those who participated, are set out in Appendix B of this report.

Following the final hearing on December 6th, 1973, the Commission and its staff spent some time reconsidering the Bhi recommendations in the light of all the evidence that had been submitted concerning them. In addition, the Commissioner examined in detail the recommended route and alternatives.

¹¹ *Op. cit.*, p. 44-49

THE RECOMMENDED ROUTE

After careful consideration of all the evidence presented to it, the Commission recommends that the proposed 500 kV power corridor from Middleport to Pickering should wherever possible be located in the Parkway Belt.

The recommended route is shown in detail in Map #1 (at the back of the report), and will be described in subsequent sections. It corresponds generally, but with some important modifications, to Bhi's "System Q" which Mr. Howlett chose as his second option. The most important change from Bhi's recommendation is that the Commission proposes that the line be built north from Middleport through the Beverly Swamp on the right-of-way presently owned by Ontario Hydro. It then crosses to the north side of Highway 401 and thence eastward to a transformer station near Milton. Just before reaching the Milton Station this east-west route is joined from the north by the lines from the Bruce Generating Station that cross the Niagara Escarpment at Limehouse. From the Milton Station there is a southward link to the Halton Station, while the main route proceeds eastward south of Brampton and north of the airport to Woodbridge, thence eastward across Yonge Street to a new Parkway Station and thence to a point south of Markham. Therefore, west from Milton to south of Markham, the route will be in the "Parkway Belt: West". From there to the Cherrywood Station a route has been tentatively selected but it is expected that this section of the line will be included in the "Parkway Belt: East" when it is designed.

Before beginning a systematic description of the recommended route, the principle factors that influenced this general decision will be outlined.

The first decision to be made was whether to accept Bhi's general recommendation of following the Parkway Belt or to reject the "Parkway Route" in favour of one of the more northerly alternatives developed by Bhi or even of some modification of Ontario Hydro's original "Middle Route". In approaching this decision, it was obviously necessary

to consider the 500 kV transmission line as a part of the total land use planning for the entire area. It is quite impossible to consider this transmission line in isolation since it is one of the biggest if not the biggest single linear land use that has yet appeared in southern Ontario. The selection of the route will have a great and lasting impact on land use planning in the whole area. Ever since the publication of the Toronto-Centred Region Plan in 1970, the Parkway Belt has figured largely in discussions of planning in the Toronto region. It has caught the imagination of the public and virtually everyone who appeared before the Commission whose land would not be directly affected by the Parkway Belt strongly supported inclusion of the 500 kV transmission line in the Parkway Belt. Bhi's strong recommendation that the transmission line be combined wherever possible with the Parkway Belt was also supported by a number of professional planners who appeared before the Commission. Apart from those whose land would be directly affected by the line the only opposition came from a few who felt that inclusion of the 500 kV line would intrude upon the park-like aspects of the Parkway Belt, which figured among the purposes of its design, and would convert it instead into a complete utility corridor. On the other hand, many pointed out that the inclusion of the 500 kV transmission line, which will necessitate widening of the Parkway Belt in some areas, would greatly strengthen its function of acting as a divider between adjacent communities.

The "Parkway Route" is also very substantially shorter than any of the other alternatives. This is a complex question that will be discussed in a later section dealing with cost. Bruce Howlett stated in his testimony that analysis of the "Parkway Route" for the 500 kV line shows that it is a very satisfactory route from the environmental and social point of view on purely geographical grounds. He pointed out that past government actions had kept the area open and comparatively free of possible conflicts with the transmission line. Even if no Parkway Belt had been designated, he feels that it would be a readily defensible route for the line. The absence of conflicts, combined with the advantages of joint use of the Parkway Belt corridor, make an overwhelming case in favour of the "Parkway Route" for the transmission line.

This decision to adopt the "Parkway Route" fixes the location of the transmission line in a general way from where it enters the Parkway Belt just east of Milton to the end of the "Parkway Belt: West", just south of Markham.

The selection of the route east and west of these points involved further choices. The section west of Milton immediately poses two very difficult choices. The first is whether to go north through or around the Beverly Swamp, and thus avoid use of the alternative east-west route south of Rattlesnake Point, and the second is to decide on the number and location of crossings of the Niagara Escarpment.

In the sections that follow these choices are discussed and the recommended route is described. The width of right-of-way, number and timing of construction of circuits for each section of the line are summarized in Table 1 on page 36. Further observations on the requirements for 230 kV lines are made on page 34.

Middleport to Highway 401 – The Beverly Swamp

In their report Bhi recommended a route for the transmission line from Nanticoke to Middleport and on to Milton, running through the gap in the Niagara Escarpment between Rattlesnake Point and Mount Nemo. This route was recommended to avoid going through the Beverly Swamp, which was felt to be a scarce and sensitive natural resource. The Commission took this concern very seriously and arranged for a panel of specialists to present their views on the Beverly Swamp, its importance and the problems of traversing it with the transmission line.

On the basis of this seminar and other evidence presented to the Commission, the Commission has concluded that the transmission line can safely be built through the Beverly Swamp on the right-of-way presently owned by Ontario Hydro. This decision was made after carefully balancing all the evidence that was presented to the Commission. Two factors in favour of building through the swamp seemed to be particularly important. The first is that the swamp has survived the construction

of several roadways through it. These were obviously built without any of the precautions that Ontario Hydro have proposed and yet the swamp survived in a form that according to the testimony of experts represents a fairly pristine swamp ecology. The second is that Ontario Hydro testified that test borings had indicated there was bedrock underlying most of the swamp not far beneath the surface. This would greatly simplify the erection of towers since they can be bolted directly to the bedrock without the need for pouring concrete.

The recommendation that the line be built through the Beverly Swamp on the right-of-way already acquired by Ontario Hydro must be surrounded with many very important conditions. The detailed plan for the siting of towers and for construction should be worked out in conjunction with the Hamilton Region Conservation Authority and the Conservation Authorities Branch of the Ministry of Natural Resources. The Commission also recommends the retention of an experienced expert in swamp and muskeg as a consultant during both planning and construction. Ontario Hydro might also invite local conservation groups to make periodic visits to the site during construction both to offer suggestions and to reassure themselves that the job was being done in the best possible way.

Ontario Hydro indicated that by bolting the towers to bedrock, by doing most of the work in winter and by doing it all using low ground-pressure vehicles, it would be possible to avoid the local damage to the terrain that can be so serious in a swamp. They also indicated that selective cutting could be relatively simple and effective because there are comparatively few big trees in the swamp. Although it was not discussed at the hearings, I would strongly urge that the possibility of putting in slightly higher towers to avoid selective cutting should be carefully evaluated. If all these precautions are taken, the Commission is confident that the line can be built across the Beverly Swamp without any continuing or cumulative damage to the existing eco-systems. Some ecologists have even suggested that it might increase the variety of flora and fauna in the swamp. The presence of the line will also guarantee the protection of the swamp against further encroachment

by other developments and will facilitate access by naturalists.

The towers in the swamp must obviously be of the lattice type since they can be erected with far less disturbance to the natural environment than can the improved appearance towers. The excavations required to bolt to the rock are much smaller, the weight of the individual elements of the tower is much less and the size of the erection equipment required is also much smaller. Since lattice towers must be used through the swamp, it would be sensible to use them continuously from Middleport to just short of Highway 401.

Throughout most of this section a right-of-way width of 545 feet is required. Two double circuit 500 kV lines are planned, one for 1976 and the second for 1982. Two double circuit 230 kV lines have an indefinite date.

The same circuit requirements continue east along Highway 401 to a point near the Escarpment crossing.

Middleport to Milton via Rattlesnake Point

Public reaction against this part of the route was very strong; many residents on or adjacent to the proposed route protested against it. Ontario Hydro and all the government ministries that expressed views on this part of the route were also opposed to it. As soon as the Commission was convinced that a line could be built through the Beverly Swamp without important damage to the environment, it became obvious that this alternative was preferable to building through the populated area between Rattlesnake Point and Mount Nemo.

The Route along Highway 401, west of the Niagara Escarpment

The recommended route, after passing through the Beverly Swamp, would continue in its northward direction to reach Highway 401 just north-west of the intersection with Highway 6. After crossing Highway 401 it would parallel the highway on the north side almost to the Halton-Wellington boundary, just east of the Mountsberg Reservoir. The

Bhi Report says:

For that portion of the route west of the Escarpment along Highway 401, it is recommended that the lines be located to the north of highway for some distance so as to avoid residences, historic homesites and other developments that cluster on and near the north side of the road. In addition, the presence of existing trees and vegetation in this area will aid in concealing the view of the towers from the highway. Depending on the number of homesites in this area and concealment of the line from view, lattice structures may be appropriate.¹²

This route will almost certainly involve the taking of some houses. Since this is highly undesirable, I re-examined alternative routes but could not find one that seemed likely to cause less social and environmental damage. As shown on Map #1, the route would then diverge from Highway 401 to pass north of the Mohawk Raceway and then turn south to go through the gap between Highway 401 and the Niagara Escarpment.

The Niagara Escarpment Crossings

The problem of selecting the best crossing or crossings of the Niagara Escarpment has occupied a great deal of the time and attention of everyone who has been concerned with selecting a route for the transmission line. In considering the alternatives, I have dismissed the possibility of underground construction in the immediate future. The reasons for this conclusion are detailed in the discussion on underground cable on page 42. Among the many locations that stand out as possible sites for crossing of the Escarpment are:

- 1) the valley between Rattlesnake Point and Mount Nemo;
- 2) the Highway 401 alignment north of Rattlesnake Point;
- 3) the gentle wooded slope north of Speyside;
- 4) the crossing through the quarry area just west of the village of Limehouse;
- 5) more northerly crossings, such as the one selected by Ontario Hydro for their "Middle Route".

¹² Op. cit., p. 46

Although it is dangerous to generalize from a small and self-selected sample, I think it safe to say that public opinion as heard by the Commission was strongly in favour of putting all the lines through the Highway 401 corridor in accordance with "System R". Ontario Hydro were strongly opposed to this alternative on grounds of both security and aesthetics. Bhi reluctantly accepted Ontario Hydro's views on security and did not recommend "System R". During the Commission hearings, Ontario Hydro were further cross-examined on security problems and presented a convincing but not overwhelming case against putting all the lines together beside Highway 401. In addition, they argued strongly on aesthetic grounds against putting four double circuit 500 kV lines side by side in such a prominent location. After carefully considering all the evidence presented, the Commission does not support "System R". The most powerful argument against "System R" is Ontario Hydro's view on systems security. From the evidence that they presented it was clear that, because a large part of Ontario Hydro's generating capacity will be located to the west of the Niagara Escarpment while the major load centre is to the east, the integrity of the circuits crossing the Escarpment is vital to the supply of the area east of the Escarpment, including Metropolitan Toronto.

"System R" would occupy a width of 862 feet along side Highway 401 in the gap through the Escarpment. The basic width of right-of-way for four double circuit 500 kV lines is 750 feet. Ontario Hydro requires that there be 200 feet between the edge of any expressway and the nearest conductor as a protection against salt spray from the road. Since the first conductor is normally 88 feet from the edge of the right-of-way this requires that the 750 foot right-of-way be set back 112 feet from the highway. A detailed study of the terrain indicates that at this width the foundations of the towers furthest from the highway would be well up the side of the Escarpment, so that the tower tops and conductors would stand out prominently against the sky. Using "System Q" there will only be two double circuit lines through the Highway 401 gap, requiring a right-of-way of 425 feet. As a result, the bases of these towers can be kept much lower and they will be far less obtrusive.

A further argument against "System R" was Ontario Hydro's preference for bringing the transmission lines from the Bruce Generating Station to the north-east of Guelph to cross the Escarpment at Limehouse. Ontario Hydro indicated that it was possible to bring the lines past Guelph to join the Highway 401 corridor, should that be required by the Commission, but made it clear that this was not their preference.

The Interested Citizens of North Halton and Wellington strongly advocated the building of one of the lines from the Bruce Generating Station to the east, so as to join Ontario Hydro's existing 500 kV north and south transmission line at Essa, which is just west of Barrie. They argued that by doing this the security of "System R" would be greatly improved. The reasons for rejecting this alternative are outlined in greater detail on page 54.

The Highway 401 Crossing

The Commission therefore recommends that the lines from Nanticoke, after passing to the north of the Mohawk Raceway as described above, should then proceed through the narrow gap between the north side of Highway 401 and the rising slope of the Escarpment. Study of the area indicates that since the right-of-way required will be only 425 feet wide, it can be put a good deal closer to Highway 401 than is shown in the Bhi Report. The edge of the right-of-way must be at least 112 feet from the edge of the highway in order to meet Ontario Hydro's requirement that the closest conductor must be at least 200 feet from the highway. As mentioned, this clearance is needed to protect the conductors from salt spray. Having studied the area, I feel that it is probably possible and desirable to have the line run south of the Fifth Side Road for a short distance, mainly in Concession 6 of Nassagaweya Township. It will have the substantial advantage of keeping the line at a much lower elevation so that the towers will appear less prominently on the skyline. The line in this area should be limited to the two double circuit 500 kV towers that are now proposed. Future 230 kV circuits should be put underground. The exact details of such a route must obviously be worked out

by Ontario Hydro in cooperation with landowners and the municipality involved.

From this point east and south to the Milton Station, the route proposed by Bhi mainly traverses good agricultural land, some of which is being farmed. The area also includes rural estate developments, especially in the wooded areas. The Bhi route avoids the rural estate development but, of necessity, crosses some active farms. Landowners in the area appeared before the Commission to express strong opposition to the route selected. Study of the area suggests that it may well be possible to find a more acceptable route somewhat to the south and west of the route chosen by Bhi. Here again, the exact details of the route must be worked out between local landowners, Ontario Hydro and the municipality, possibly with the assistance of Bhi.

The line from the Limehouse crossing which comes south through the centre of Concession 5 of Esquesing Township will join this line north of Highway 401. The exact point of junction will, of course, depend on the details of the final route chosen for the east-west lines. In any case, the distance from the junction to the Milton Station will be very short, thus minimizing the risk of interruption of all circuits at this common point.

The Limehouse Crossing

Almost everyone who has considered the problem of building a transmission line across the Niagara Escarpment has selected the vicinity of Limehouse as an area where a crossing can be made with relatively little environmental damage or social disturbance. However, as is the case with all the desirable crossings of the Escarpment, the problems of getting to and away from the crossing are complex. The details of the route to the Limehouse crossing from the north have been worked out by Ontario Hydro, in public meetings in connection with the Bradley Junction to Georgetown study. The details of the route south of the Escarpment down to Highway 401 have been discussed with the public by Bhi in earlier public hearings and were the subject of many submissions to the Commission by municipalities, organizations and individuals. The Commission supports the route selected by Bhi approximately in the centre of Concession 5 of Esquesing

Township. The Ontario Hydro study to recommend a route from Bradley Junction to Georgetown also concluded that the centre of Concession 5 provides the best approach to the Limehouse area from the north. This alignment crosses the Escarpment just west of the village of Limehouse and continues down the centre of Concession 5 to a junction with the east-west lines from Nanticoke just north of Highway 401. In this section, from Limehouse to Highway 401, the exact location of the route and tower locations should be adjusted to minimize the impact on local landowners. The decision to recommend a route running south from Limehouse to the vicinity of Milton was not an easy one, since this is certainly a very attractive part of rural Ontario containing both good farms and fine rural estates. Representatives of the Township of Esquesing and several local residents put most persuasively the case against building the line in this area. All available alternatives were carefully considered before the Commission reluctantly came to the conclusion that, on balance, this was the route that the transmission line should take.

For this section of the route Ontario Hydro requires a 720 foot right-of-way; 600 feet for three double circuit 500 kV lines (2-1977, 1-1980) and 120 feet for two later 230 kV lines. Because of the nature of this area every effort should be made to reduce this width if new technology makes this possible.

The Parkway Belt, Milton Station to Parkway Station

The Commission agrees with Bhi's recommendation that the 500 kV lines should be included in the Parkway Belt from Milton Station right through to the eastern extremity of the "Parkway Belt West", just south of the Town of Markham. In their testimony to the Commission the Parkway Belt planners indicated that they felt it would be feasible to do this, but made it clear that they had not yet done the detailed planning necessary for use of the Parkway Belt for many different purposes, including the 500 kV transmission line. Therefore, after recommending that the line go in the Parkway Belt, the Commission cannot specify the route in any greater detail. The exact location of the 500 kV line will have to be worked out by the Parkway Belt planners, in each segment of the route,

as they proceed with detailed planning. For that reason the description of this section of the route which follows is in very general terms. It specifies, in more detail, areas where particular care will be required. These will be obvious to the planners, but are repeated here in order to be certain that they will not be overlooked.

Milton Station to Halton Station

The proposed location of the Milton Station, south of Highway 401 between the Fourth Side Road and the Fifth Side Road in Central Halton and adjacent to the Canadian Pacific Railway tracks, is supported. The area is large enough that the two houses on the Fifth Side Road need not be disturbed. In Bhi's Report, they have proposed two lines running eastward from Milton Station: one, just south of Highway 401, leading to the Woodbridge Station; and the other, just north of the Canadian Pacific Railway tracks, leading to the Halton Station.

Since the lines at this point will be in the Parkway Belt, their exact location will have to be determined by the Parkway Belt planners. However, should it fit the Parkway Belt plan, the Commission feels that, since the lines will in any case be very close together, it would appear to be preferable to accept the slight reduction in security that would be caused by putting them together along side the Canadian Pacific Railway tracks, thus greatly reducing the visual impact on Highway 401. This routing would require a slight northward bend in the line as it crosses Highway 401 but would result in a better crossing of the highway.

The Halton Station is a major focal point in the 230 kV distribution system. The 500 kV connection from the Milton Station to the Halton Station is, therefore, of great importance. It will require a 545 foot right-of-way for two double circuit 500 kV lines and two double circuit 230 kV lines. There is no doubt that this line can be accommodated in the Parkway Belt; however, there has been considerable uncertainty and controversy as to whether this section of the Parkway Belt is to be in Concession 9 or 10 of Central Halton. The Town Plan for Oakville has for a long time shown a power line in Concession 10 and Ontario Hydro

does own a right-of-way in this area, so it would seem logical to put the 500 kV line in Concession 10.

Examination of existing land uses for the two concessions indicates that Concession 10 is at least as suitable as Concession 9. However, if planned uses are also considered, the balance probably favours the use of Concession 9. A possible solution might be to put the Parkway Belt partly in Concession 9 and partly in Concession 10, with the highway in Concession 9 in accordance with existing plans and the transmission line in Concession 10. The Halton Station would then be located, on land already owned by Ontario Hydro, in Concession 10.

This is a problem that obviously cannot be settled either by this Commission or by Ontario Hydro and must be left to be settled by the Parkway Belt planners in consultation with Ontario Hydro and the local municipalities. The Commission's important recommendation is that the transmission line should be incorporated in the Parkway Belt in whatever location is finally selected.

Milton Station to Woodbridge Station

From the Milton area the recommended corridor proceeds eastward, at first south of Highway 401, crossing it to follow future Highway 407 to Woodbridge. The right-of-way will be 545 feet wide and will contain two double circuit 500 kV lines and two double circuit 230 kV lines. This alignment will require special care when the line crosses the Credit River, the Meadowvale Conservation Area, the Toronto International Airport and the Clairville Conservation Area.

In the area where the corridor passes north of the Toronto International Airport the height restrictions set by the Federal Ministry of Transport, as described in their regulations for the Airport, limit tower heights to an elevation of 720 feet above sea level. According to the Bhi Report, "Ground elevations range between 580 and 600 feet above sea level in the vicinity, thereby restricting tower heights to 120 to 140 feet. Hydro has indicated that it can build improved appearance double circuit 500

kV towers 140 feet high (which is 22 feet below conventional structure height). This height could fall within airport height requirements depending on line placement and no additional right-of-way would be needed."¹³ In addition, there is a further height restriction in line with the north end of Runway 10 which might require the towers, for a distance of about 4,000 feet, to be reduced to a height of approximately 90 feet. Such a height could certainly be achieved by replacing the two double circuit towers by four single circuit towers and by spacing the towers more closely. This would require some widening of the right-of-way. In addition, Ontario Hydro should study the design of some new 400 kV double circuit towers, which are only 104 feet high, that have been made by the Central Electricity Generating Board of Great Britain. Ontario Hydro have themselves published papers on new ideas for very compact and low towers, some of which could almost certainly be applied in this case. As a last resort, a short length of cable could be used, either buried or in a surface trough. The possible effect of the transmission line on navigational and landing aids must also be considered. Ontario Hydro has indicated to the Commissioner that preliminary discussion with the Federal Ministry of Transport suggests that a solution to this problem can also be found. The design and construction of this section of the line will obviously require close cooperation between the airport authorities, the Parkway Belt planners and Ontario Hydro.

As the Bhi Report states, "The proposed 230 kV lines, if built overhead would fall within airport height restrictions and no special arrangements should be needed."¹⁴

The Bhi Report continues, "The proposed Woodbridge Station will be located in the Parkway Belt. According to Hydro it will require a site about 2400 feet by 1900 feet in size. Lines from the north would interconnect with the Middleport-Pickering corridor at this point."¹⁵ The Commission feels that the station site might be either east of Highway 27, as suggested by Bhi, or west of the highway. The final selection should be made to minimize the impact on existing land uses of the connecting lines from this station northward to Kleinburg.

¹³ Ibid. p. 52

¹⁴ Ibid. p. 52

¹⁵ Ibid. p. 52

Woodbridge Station to Kleinburg Station and North

This north-south link is needed to connect Ontario Hydro's 500 kV system through Barrie to Sudbury and the north to Woodbridge, where a new station would be required. The new line would follow an existing right-of-way containing several 230 kV lines. Ontario Hydro has indicated that it requires three double circuit 500 kV lines on this segment, two in 1976 and one in 1982, requiring a right-of-way 600 feet wide. Ontario Hydro have also indicated an indefinite requirement for one double circuit 230 kV line, at a later date, which could occupy a further 60 feet. If the existing 230 kV lines can be removed before the erection of the 500 kV lines, this would substantially reduce the new right-of-way required. In any case, the width should be kept to a minimum and care should be taken to avoid existing houses wherever possible. As indicated above, the exact location of the Woodbridge Station will substantially influence the impact of this northward line.

Woodbridge Station to Parkway Station

This link follows the Parkway Belt in its entirety. Care will be required in siting the corridor where it crosses the Humber River north of the Black Creek Pioneer Village, at the crossing of Yonge Street at Highway 7 and east of Bayview before linking into Parkway Station. The right-of-way will be 545 feet wide, to include two double circuit 500 kV lines and possibly two double circuit 230 kV lines.

Parkway Station to Cherrywood Station

This link follows the Parkway Belt as far as Highway 48 south of Markham where the Parkway Belt presently ends. The Government has announced in its policy statement of June 4th, 1973, "The Parkway Belt: West", its intention of continuing the Parkway Belt east of Markham. This section is presently being designed. The Commission strongly recommends that this design include the route of the 500 kV line to the Cherrywood Station.

The Commission has given careful consideration to the many submissions that were made suggesting alternatives to the route selected by Bhi, especially those recommending more southerly routes. On balance, the Commission supports the route recommended by Bhi. This parallels the Canadian National Railway by-pass line east and south to the point where the Canadian National Railway line crosses the east-west Canadian Pacific line. Examination of this section, from Highway 48 to the Canadian Pacific line, with the staff of Bhi suggests that some detailed revision of the exact location of the line could result in the removal of fewer houses. This obviously should be done if at all possible.

In a revised plan for expropriation of land to create the new North Pickering community (published January 10th, 1974), The Honourable John White, Minister of Treasury, Economics and Intergovernmental Affairs, proposed the establishment of a greenbelt along the west and south sides of the community. The route proposed above lies in the western section of this greenbelt. The main line of the Canadian Pacific Railway marks the northern boundary of the southern section of the greenbelt. At the request of the Commission, Bhi staff examined the possibility of putting the 500 kV line alongside the railway in this area. Their study suggests that there is an acceptable route for the 500 kV line in this section on the north side of the Canadian Pacific Railway tracks. If the transmission line were built in this location, the area under the line would become a part of the proposed greenbelt and together with the railway would form a multiple use parkway. If this were done, it would probably be reasonable to move the lines south from the existing Finch right-of-way to include them in the same corridor. The details of such a plan must obviously be worked out between Ontario Hydro, the Parkway Belt planners and the local community. Judging from the views expressed to the Commission by residents of the area, this route would commend itself to all but those few whose properties would be directly affected by the line along the north side of the Canadian Pacific Railway tracks. This section of the route requires a 660 foot right-of-way for three double circuit 500 kV lines and one double circuit 230 kV line.

Parkway Station to Newmarket Station and North

In the terms of reference given to Bhi, they were asked to study and make recommendations on north-south connections, including the link between the Parkway Station and the Newmarket Station. This link was an integral and essential part of several of the northern routes that were examined, including Ontario Hydro's original "Middle Route", but is not involved at all in the "Parkway Route" that has been recommended. In addition, Ontario Hydro did not present any specific plans for a northward extension of this route to connect with a future generating station that might be built on Georgian Bay. I have, therefore, concluded that it would not be appropriate for the Commission to make a specific recommendation on this part of the route.

However, I do urge Ontario Hydro to proceed as soon as possible with a more specific outline of the requirement for this route in order to have a right-of-way reserved before the area becomes even more built-up. In accordance with the principle of joint use of linear rights-of-way, I would recommend that this route should as far as possible be co-located with Highway 404. The present proposed route for Highway 404 passes so close to the west of Buttonville Airport that it might not be possible to put the 500 kV transmission line in the same right-of-way at that point. It would, therefore, probably be necessary to use a route, such as the one outlined by Bhi, which goes to the east of Buttonville Airport until just south of Victoria Square. At this point the line will veer west to join Highway 404 and from there northward the transmission line should be located and designed in close cooperation with the designers of the highway and the intended Parkway Belt. The Commission was presented with conflicting advice concerning the exact location of the transmission line in relationship to Highway 404. Some would like to see the line to the east of the highway and some to the west. The Commission takes no sides in this argument but does urge the earliest possible resolution of the problem.

Stations: Milton, Halton, Woodbridge and Parkway

All of these stations will be quite large and potentially prominent

features of the landscape. Therefore, the Commission strongly supports the Bhi recommendation that:

Because of the comparatively flat, open character of the terrain, it is recommended that a low profile station be constructed utilizing SF6 switchgear as much as possible. Screen planting should commence as soon as the site is acquired, using well developed vegetation so as to ensure rapid concealment. The use of SF6 cable from the station out to transmission lines is preferred, if equipment is available.¹⁶

In the Bhi report, this recommendation is applied to the Woodbridge Station but it applies with equal force to all of the stations on the line. This recommendation also conforms very closely to the findings of the citizens committee on station design.

The use of SF6 switch gear, bus bar and local transmission lines has made possible a revolutionary change in the total size and visibility of transformer and switching stations. Ontario Hydro has been in the forefront in pioneering the use of SF6 switch gear and can be depended upon to make these stations models of what can be achieved with this new technology.

Requirements for 230 kV lines in the 500 kV Right-of-Way

Throughout the proposed system, Ontario Hydro has included a varying number of 230 kV lines in the same right-of-way as the 500 kV lines. Bhi have, with very few exceptions, recommended that these lines should be put underground when they are required, using either improved underground cable technology or the DAMUT system. The Commission does not support such a general policy of undergrounding, since it would seriously limit the options open to Ontario Hydro in the future. The Commission recommends that, where Ontario Hydro has specified the need for a 230 kV line up to and including 1985, every effort should be made to include enough land in the right-of-way for an overhead line. Lines for which a specific 230 kV requirement by a definite date have been stated are: Milton to Woodbridge (1980); Parkway to Cherrywood (1983); Milton to Halton (1985) and Woodbridge to Parkway (1985). In

¹⁶ Ibid. p. 52

all of these cases, it should be possible to obtain a sufficient right-of-way width to accommodate these lines and this land should be acquired now.

Where the date of construction of a 230 kV line is given as "indefinite", the case for buying the land now is less obvious. Where the required land can be obtained without taking occupied houses or very seriously interfering with other important land uses, Ontario Hydro should be permitted to acquire the land now. One notable exception is the route through the Escarpment alongside Highway 401. Here, any additional 230 kV lines should be placed underground. This section of underground cable should be long enough to avoid any further cluttering of the view, at the Escarpment crossing, from Highway 401 both west and east bound. The section will at most need to be only a few miles long.

In addition, should the Parkway Belt planners encounter serious difficulty in fitting the 230 kV lines into their plans at sensitive points, such as the Yonge Street crossing, appropriate sections of the 230 kV lines should be put underground in the Parkway Belt.

In recommending this policy, the Commission does support the Bhi view that high voltage transmission lines should in general be placed underground as soon as it is reasonable on economic and technical grounds. Where the Commission disagrees with Bhi is in committing Ontario Hydro in advance to extensive undergrounding in specific areas. When the time comes there may be very good reasons for Ontario Hydro to spend its money in some other way and it would be a mistake to take actions today that will seriously limit options ten years from now.

The Commissioner believes that, by 1985, many but not all new 230 kV lines will be put underground. The pressure for undergrounding will be mainly in heavily built-up urban areas and in rural beauty spots. At the same time, there will probably still be many new overhead lines being constructed in suburban and rural locations and it would be highly advantageous for Ontario Hydro to get the rights-of-way in such areas now.



Table I

Middleport to Pickering: Right-of-Way Requirements for
Double Circuit High-Voltage Transmission Lines

Section	Total Width	500 kV	230 kV Definite	230 kV Indefinite
Middleport to Milton	545'	425' (1-1976, 1-1982)	—	120' (2)
Milton to Georgetown	720'	600' (2-1977, 1-1980)	—	120' (2)
Milton to Woodbridge	545'	425' (1-1976, 1-1977)	75' (1-1980)	45' (1)
Woodbridge to Kleinburg	660'	600' (2-1976, 1-1982)	—	60' (1)
Woodbridge to Parkway	545'	425' (1-1978, 1-1983)	75' (1-1985)	45' (1)
Parkway to Cherrywood	660'	600' (2-1978, 1-1983)	60' (1-1983)	—
Milton to Halton	545'	425' (2-1977)	75' (1-1985)	45' (1)

Source: Bhi calculations, based on
Ontario Hydro's Brief of
July 31, 1973.

Choice of Tower Design

During its initial hearings in 1972, the Commission was presented with information on tower design by Ontario Hydro. Further information was presented during cross-examination and, in addition, Bhi formed a "citizens' committee" on tower design and presented its report to the Commission.

Very briefly, three classes of tower designs are available:

- 1) guyed towers;
- 2) self-supporting lattice towers;
- 3) "improved appearance" towers.

Guyed towers are slender and unobtrusive and are the lightest of all types of towers. Good examples of 500 kV guyed towers can be seen on Ontario Hydro's northern right-of-way coming down to the Kleinburg Station. Ontario Hydro did not recommend guyed towers for the Middleport to Pickering transmission line. There was no evidence of public support for them and they were scarcely mentioned during the Commission hearings.

Many styles of lattice towers were considered including a novel design with a large inverted triangle at the top which Ontario Hydro presented as their first choice for their "Middle Route". Lattice towers are light, cheap, strong, easily erected, easily repaired and relatively unobtrusive, especially at a distance, because the mass of metal in them is small. Nonetheless, they were not received with enthusiasm by the public. Ontario Hydro's new design was particularly unpopular.

The so-called "improved appearance" towers are of many different designs, though in all of them the structure is reduced from a lattice to one, two or, at most, three main vertical members. Ontario Hydro agreed that many citizens prefer the appearance of these towers but pointed out their disadvantages.

Typically, the single shaft design is twice as heavy and twice as costly as a comparable lattice structure. Erection causes very much greater local disturbance because foundation depths are much greater



Figure 2

Double circuit 365 kV "improved appearance" tower,
similar in design to that proposed for use at
500 kV by Ontario Hydro.

(Source: Detroit Edison)

and the volume of concrete in footings many times larger. In addition, the cranes required for erection are very large and heavy.

Table II
Comparison of Standard Lattice and
Standard Steel Pole Structures

<u>Feature</u>	<u>Lattice Structure</u>	<u>Steel Pole Structure</u>
Foundations	4 footings per tower each flared at base: 3' in diameter at top, 12' in depth and 8' in diameter at flared base concrete required: 27.5 cu.yd./tower	1 cylindrical footing per tower, of 35' in depth and 7.5' in diameter concrete required: 57 cu.yd./tower
Area occupied by tower base	961 square feet	44 square feet
Weight	15 tons	37 tons

Source: Ontario Hydro

The citizens' committee on tower design strongly favoured the so-called improved appearance towers and recommended that the single shaft design should be used throughout the entire route if it was obtainable. Bhi modified this proposal to suggest a few places where conventional towers were recommended. During their testimony, Ontario Hydro presented recommended guidelines for the installation of improved appearance transmission structures. These are reproduced as Appendix A. Applying these guidelines to the route recommended by the Commission, it appears that conventional lattice structures would be used only on the section from Middleport to Highway 401. All the rest of the line, with the possible exception of the sections from the Woodbridge Station to the

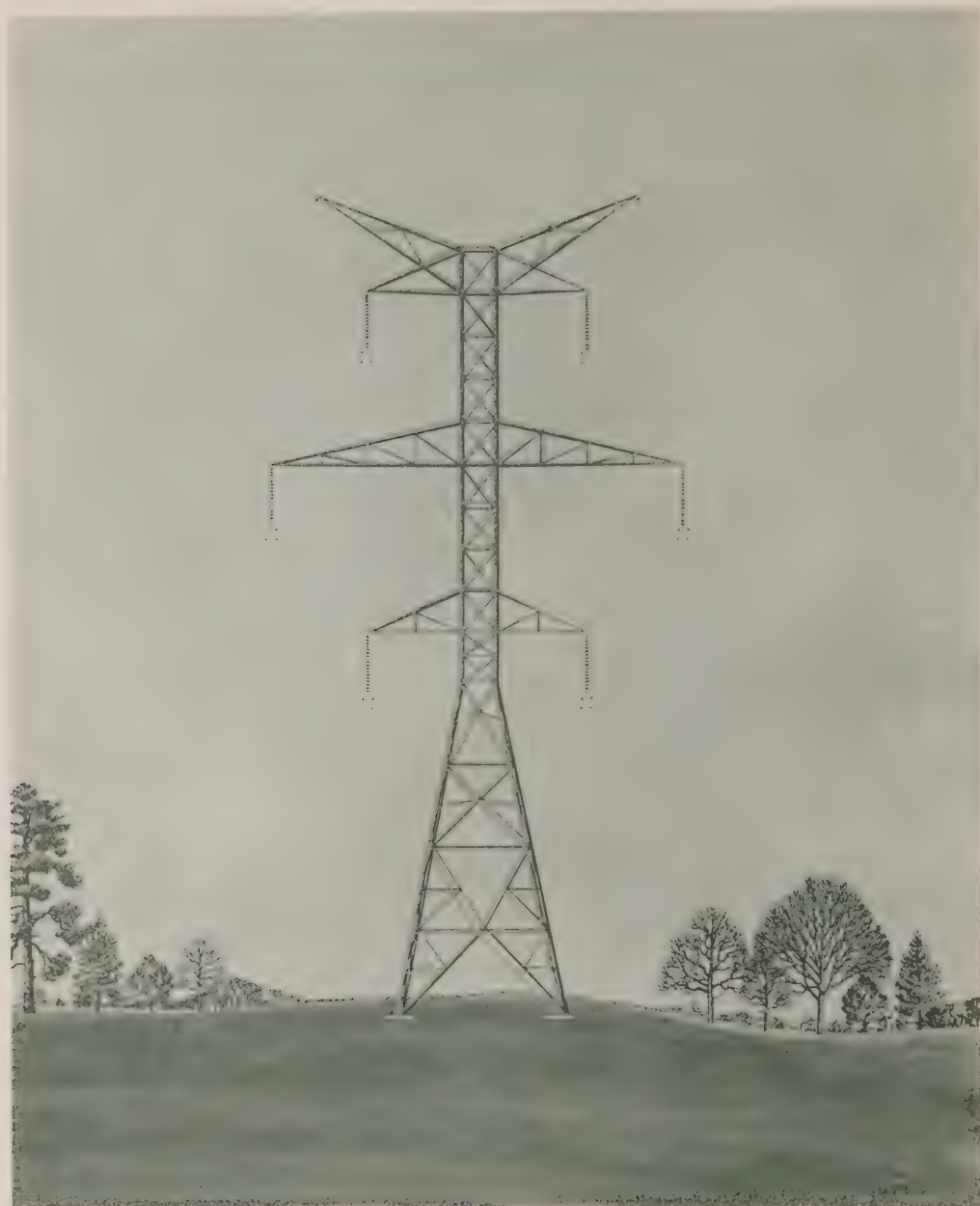


Figure 3

Artist's illustration of the proposed design
of a double circuit 500 kV lattice tower.

(Source: Ontario Hydro)

Kleinburg Station and from the Limehouse crossing to Highway 401, would fall in one or other of the categories for which Ontario Hydro recommends improved appearance towers. The link from the Woodbridge Station to the Kleinburg Station will be viewed from Highways 27 and 50, and to some extent from Highway 407, and so it also should have, according to Ontario Hydro's recommendations, improved appearance towers. The section from Limehouse to Highway 401 will be seen from the Escarpment, and from Highways 25 and 401.

The Commission, therefore, recommends the use of improved appearance towers throughout the proposed route, except on the section from Middleport, through the Beverly Swamp, to near Highway 401.

In making this recommendation the Commission wants to emphasize the fact that, according to Ontario Hydro's calculations, the cost of the improved appearance structures will exceed the cost of standard lattice towers by more than \$40 million. By 1985 this would increase the cost of power throughout Ontario by approximately 0.15% and would add about 62¢ a year to the average residential power bill, \$4.30 to the average commercial bill and \$36.00 to the average industrial bill. It is cold comfort to the consumer to note that the average residential customer's bill, which was \$110.82 in 1971, is forecast to be \$554.10 in 1985.

The Commission strongly supports Ontario Hydro's view that lattice towers should continue to be regarded as the standard for transmission lines and should be used in all ordinary rural locations in the future. The Commissioner feels that lattice towers are less visible in a landscape at a reasonable distance and, therefore, have on average less visual impact than the bulkier single shaft towers. This view, which is widely held in Britain, was extremely rare among those who appeared before the Commission. Public opinion was almost unanimously in favour of the improved appearance towers.

The Commission also supports the following recommendation of Bhi concerning the Niagara Escarpment crossing at Highway 401:

The recommendation for this crossing is for very low, single pole, double circuit towers to be used, and that they cross the Escarpment at a shallow angle with trees left between lines for concealment. Ontario Hydro is currently studying tower colour and it is suggested that this crossing become an experimental research area. Initially, it is recommended that towers located over the Escarpment be painted light grey or light blue for the portion visible against the sky, with earth tones for that portion below skyline view. The compatibility of these colours should be observed for one year throughout all four seasons and the towers repainted with different colours if deemed appropriate.¹⁷

Ontario Hydro also stated that under exceptional circumstances, they could, by reducing the space between towers, use improved appearance towers which were shorter than the standard ones. They could also, for short distances and at some sacrifice both in security and ease of maintenance, pack parallel power lines into a right-of-way narrower than is standard. The recommended route has not yet been established in sufficient detail to make specific suggestions as to where advantage might be taken of these possibilities. However, the Commission does urge that Ontario Hydro should not hesitate to use these special techniques where they will significantly reduce the social or environmental impact of the line. This may be particularly appropriate in areas like the Parkway Belt, where the line would in some places be between urban areas of a substantial density.

Underground Transmission

Throughout all the hearings of the Commission, the desirability of placing the 500 kV lines underground, especially in sensitive areas such as the Niagara Escarpment crossing, was a recurrent theme. At the early hearings on the "Middle Route", Ontario Hydro presented evidence to show that while there are substantial and increasing mileages of underground cable in operation at lower voltages there are as yet no significant installations of 500 kV underground cable.

¹⁷ Ibid. p. 46

Extensive test work at 500 kV has been completed but Ontario Hydro argued that the technology was not yet sufficiently advanced or proven to make it prudent to use any substantial length of underground cable in a link of such great importance to the network as the proposed Nanticoke to Pickering line.

Underground cable is extensively used in most major power systems. It is typically confined to urban areas and the voltages used have been steadily increasing but have not yet reached 500 kV. The highest voltage lines in regular use are the 400 kV lines in Great Britain, but some 500 kV lines are planned and in the process of installation in the United States. Reliability, even at voltages as low as 115 kV, is still far below that for overhead lines and is not considered satisfactory by the utilities concerned.

In its Interim Report, the Commission supported Ontario Hydro in the view that the undergrounding of a high capacity 500 kV line is not at present technically and economically reasonable.

In its report to the Solandt Commission, Bhi recommended quite extensive use of underground power transmission both 230 kV and 500 kV, beginning about 1982. The recommendation on which attention was especially focussed was for the installation, by 1982, of six miles of 500 kV underground cable through the gap in the Niagara Escarpment either south of Rattlesnake Point or along Highway 401.

Because of the Bhi recommendation and because public support for putting the lines underground was so strong, the Commission felt it necessary to call other expert witnesses to support or refute Ontario Hydro's previously presented views.

Six expert witnesses appeared together as a panel. Their names and qualifications are given in Appendix B. The experts began by giving a series of papers which together formed an introduction to the problems of underground power transmission. Then each gave a statement of his

own personal views, discussed these views between themselves and finally were subject to cross-examination by Ontario Hydro, municipalities, organizations and the general public.

The technicalities of the subject are very complex and even the testimony given during the 2½ days of panel discussion is too voluminous to summarize in this report. What follows is a very brief summary of the Commissioner's views on the subject formed as a result of this evidence.

There are at present only two very similar technologies sufficiently advanced for Ontario Hydro to consider them as possibilities for the present line. These are the self-contained underground cable that has been used in all the British installations and the pipe cable that is favoured in the United States. Ontario Hydro favours the self-contained cable and their planning and cost estimates for the Rattlesnake Point installation were based on the use of this cable.

Other techniques, such as spacer gas cables, including both DAMUT and SF6, nitrogen-cooled and super-conductive cables and direct current underground cables, were all discussed but were dismissed as not yet being ready for a major installation. They are discussed in somewhat more detail in a later section of this report entitled, "The Future of Long Distance Transmission".

All the experts agreed that, with existing technology, underground high voltage cable installations are much more expensive than overhead systems (on the order of 15 to 25 times) and much less reliable than comparable overhead systems (by a factor of 10 to 100 or more). This unreliability is due not to a higher failure rate but rather to the greatly increased time required to repair a failure. The reliability of an underground installation can in theory be made equal to that of an overhead installation by adequate redundancy but this naturally further increases the cost.

In some cases where the unreliability is due to the recurrent failure

of one or more novel elements in the cable installation (e.g. stop joints in CEGB's oil-filled 400 kV cable system accounted for over 60% of the total outage time) any acceptable redundancy will not achieve equal reliability to a good overhead line. In the light of this testimony by the experts, the Commission concludes that if Ontario Hydro started now it could have a six mile section of 500 kV underground cable operating by 1982. The extra cost for the six miles would be between \$50 and \$80 million. This would include sufficient redundancy to provide acceptable reliability provided that failures in the system were random and were not caused by a recurrent defect in some new element in the system. Although this would meet the Bhi timetable for undergrounding, the resulting installation would be done using mainly existing technology at or above current cost estimates. All the experts agreed that none of the new and potentially lower cost solutions, such as DAMUT, would be available for a 1982 in-service date.

The Commission concludes that 500 kV underground cable is not at present an attractive alternative and that neither the cost nor the security risk are justified by the improvement in environmental impact that would be achieved.

The Bhi Report recommended that at several points, such as Rattlesnake Point or the Niagara Escarpment crossing at Highway 401, future lines should be put underground and the initial overhead lines should be replaced by underground lines by 1982, or as soon thereafter as underground construction became technically and economically reasonable. The Commission has much sympathy with Bhi's feeling that power lines should be put underground in sensitive areas just as soon as possible, but nonetheless does not feel it wise to support Bhi's recommendations. In the future long distance underground power transmission will undoubtedly become cheaper and hence more widely used. Whether this will be in the form of improvement of existing underground cable technology or by one of the other possible techniques is hard to predict. The Commission feels that it is quite possible that high voltage DC cables, spacer gas insulated cables, nitrogen cooled cables

or some other technical advance may easily overtake existing high voltage cable. Whatever the technology favoured at the time, Ontario Hydro will certainly have an ongoing program of underground power transmission. However, the areas in which it chooses to spend the extra money available for underground transmission will have to be decided year by year as land use changes and population grows. When the time comes that money could be made available to meet a commitment to put transmission lines on the Niagara Escarpment underground, there might well be almost unanimous feeling that the money could be better spent by putting lines underground in some other area or by spending the money on some other kind of amenity. Therefore, the Commission recommends that Ontario Hydro do everything possible to make the proposed transmission line visually inoffensive, even in the most sensitive areas, but accept no commitment for future undergrounding of these lines after they have been constructed. The decision as to whether future construction in the same route should be underground or overhead must then be taken in the light of the situation when these decisions have to be made.

Cost Considerations

Throughout the hearings of the Commission relatively little time was devoted to discussing the comparative costs of various routes. Public attitudes toward costs covered a very wide spectrum, and ranged from those who said that the best route from the environmental and social point of view should be selected, regardless of cost, to those who said that the shortest, cheapest and most direct route should be chosen without regard to other factors.

In considering the comparative cost of two different routes, costs can be divided into two classes: quantifiable and non-quantifiable. In the first class are direct construction costs, including the costs of towers, conductors, insulators, equipment for switching and transformer stations and all the labour that goes into the job. Also included, but quantifiable only with difficulty, are land costs. These can be estimated in a fairly general way but will never be known

exactly until after the land has been acquired.

In the present case, even the estimates of direct costs for material and labour in building the lines are open to argument. One of the obvious points for debate was the total length of the alternative routes. In its final and most detailed submission on this subject, Ontario Hydro indicated that the route mileage of the alternatives varied only from 144 to 153 miles. This conclusion was arrived at by including in the route mileage all the 500 kV lines that they felt would have to be built at any time in the foreseeable future within an area that roughly coincided with the study area. On this basis, Ontario Hydro assigns a route length of 144 miles to "System Q". ("System Q", as described in the Bhi Report, is the same as the route recommended by the Commission, shown on Map #1, except that it goes around the Beverly Swamp instead of through it. The difference in distance is negligible.) In this mileage, Ontario Hydro includes 20.5 miles of the Transmission line from the Bruce Generating Station as it approaches Milton; 8.2 miles of the "Essa to Kleinburg" route north of the Kleinburg Station and 18 miles of the route from the Parkway Station north toward Georgian Bay. None of these are parts of the Nanticoke to Pickering line; subtracting them reduces the route mileage, including connections to Halton, Woodbridge and Parkway Stations, by 46.7 miles, giving a new total of 97.3 miles. The original Ontario Hydro "Middle Route" is also listed as 144 miles long. If the same logic is applied, it appears that only the 3.8 miles north of Newmarket is not essential to the function of the Nanticoke to Pickering route and its connections to the Halton, Woodbridge and Parkway Stations. Therefore, on the same basis the original route of Ontario Hydro is 140.2 miles long. This result is not surprising, since in order to perform its function the line must be connected to the four stations at Halton, Woodbridge, Parkway and Cherrywood. As the route selected moves north of these stations not only does the main line become longer but the connections to the stations also lengthen. One of the principle advantages of "System Q" is its short length, and the Commission feels that the shorter length should be used in comparing the alternatives.

Nonetheless, the taxpayer should not be deluded into believing that this will ultimately save much money, for in most cases it is merely the transferring of costs from one classification to another. This is most clearly illustrated by the length from the Halton Station to the Bruce Generating Station. In considering "System Q", the entire route from Milton to the Bruce Generating Station is regarded as being part of the Bruce Transmission System. On Ontario Hydro's "Middle Route", about 20 miles of this has been included in the Nanticoke to Pickering route as it is an integral part of the latter. The cost of this section to the taxpayer will be the same, whether it is included in one or the other system.

Even greater difficulties are encountered when an effort is made to evaluate the comparative environmental and social costs of different routes. How much is it reasonable to pay for improved appearance towers? How much is it reasonable to pay to lengthen or divert the route in order to reduce the impact of crossing the Niagara Escarpment? Probably even more pertinent to the present discussion, how much is it worth to have the line located in the Parkway Belt, where it contributes to the creation of a multiple use corridor that is expected to be a major factor in improving the whole pattern of land use in the Toronto-Centred Region?

Ontario Hydro's estimate of cost for four alternative routes is shown in Table 3. It was subject to some detailed criticism during cross-examination but can safely be accepted as a rough measure of comparative cost. It will be seen that, using Ontario Hydro's route mileage, "System Q" would cost about \$40 million more than the original Ontario Hydro "Middle Route". This difference is due to the greater costs for property in "System Q". These costs are partly offset by higher station costs on Ontario Hydro's route. However, if the costs of "System Q" are reduced, to provide for a 100 mile right-of-way instead of a 140 mile right-of-way, the cost of the two routes is approximately the same.

Table III*
Comparison of Cost Differences Between
Routes (\$,000)

(Present Value of Capital to End of
1985 Discounted at 7% per annum)

	System Q	System S	System T	Hydro Route
Property	106,100	77,400	64,800	59,700
500 kV Lines	121,500	118,600	119,000	101,700
Stations	106,700	120,000	132,800	134,300
Communications	1,300	300	400	400
Grand Total	<u>335,600</u>	<u>316,300</u>	<u>317,000</u>	<u>286,100</u>
Comparative Route Mileages	144	153	153	144

- Notes:
1. All 500 kV lines are 2 cct construction except for a section north of Malton Airport in "System Q" where 1cct low profile towers are used.
 2. Certain facilities which are common to all alternatives are not included in the costs.
 3. Property costs for "System Q" include an extra 100' buffer zone wherever the line is alongside an expressway.
 4. Route mileages include the east-west corridor from a point west of Freelon to Oshawa Station area, and the north-south corridors.
 5. Lattice and steel pole towers according to Ontario Hydro guidelines.

* Adapted from information provided by Ontario Hydro.

Bhi has also argued that it is not reasonable to assign the full additional property costs in the Parkway Belt to the transmission line, since at least some of the property expenditure would have been made by the citizens of the province in any case during the acquisition of the Parkway Belt. For example, there will be cases where a strip of land would have to be purchased for a buffer zone between other land uses, such as between an express way and an adjacent residential area. Where the right-of-way primarily required for the power line can also serve as such a buffer zone, there will be a direct saving to the taxpayer. It is impossible to assign an exact value to such savings but the total will probably be quite significant.

In discussing the division of costs for land in the Parkway Belt, it would seem appropriate to note the advantages of having all the property in the Belt that is required by any Government Ministry or by Ontario Hydro held by one central provincial authority. If, instead, part of the right-of-way is owned by Ontario Hydro, part by the Ministry of Transportation and Communications and part by the Ministry of the Environment, for example, there may well prove to be great difficulties in distributing later land uses between the various ownerships. It would be far better to have one authority own and generally manage all land in the Parkway Belt, which could then loan or lease acquired areas to the appropriate Ministries, agencies, municipal governments and even private users to meet their varying needs.

It is, therefore, clear that the decision as to which route is to be preferred cannot be made on cost grounds alone since the cost differences are not decisive. Each person will make their own decision, depending upon the value they attach to the differences in social and economic impact between the various alternative routes.

Obviously, since the Commission has recommended the inclusion of the 500 kV line in the Parkway Belt, the Commission feels that if any extra expenditure is incurred it will be amply justified by the social and environmental benefits that will be achieved. The Commission also felt

that it was not worthwhile putting time and effort into further refining of the cost estimates when the most important elements in the decision are not quantifiable.

System Security

Throughout all the hearings of the Commission there have been recurrent references to the problems of system security. At the earlier hearings in 1972, several people questioned the number of parallel single circuit lines that Ontario Hydro recommended for each link. When Ontario Hydro was asked to replace these single circuit lines by double circuit lines, the audience was mystified by their insistence that two double circuit lines containing a total of four circuits were required to replace three single circuit lines in order to achieve a comparable level of security. Interest in security problems came to a climax in the discussion of "System R". This was the proposal whereby all the power from both the Nanticoke Generating Station and the Bruce Generating Station would be routed along a single right-of-way parallel to Highway 401, through the Niagara Escarpment.

Ontario Hydro strove manfully but without complete success to explain their concepts of security to the Commission and to the audience. It would not be possible to review all the arguments and discussions. The following points give some indication of why the Commission has attached substantial importance to Ontario Hydro's views on security.

Early in its testimony, Ontario Hydro explained that it was a member of the Northeast Power Coordinating Council, which comprises electric utilities of New Brunswick, Ontario, New York and the New England States. The interconnections with the other utilities that are members of this Council are of considerable importance to Ontario Hydro, and it can only maintain these interconnections if it continues to meet the security requirements of the group. These requirements can be briefly paraphrased to say that the system must contain sufficient redundancy that the system will still function effectively if one major element of the system is out of service

for maintenance and another similar element accidentally fails. In more simple terms this means that every major element such as a transmission line must be triplicated. Ontario Hydro would regard this as an over-simplification of their practice, but it can serve as a rough guide for the layman. During cross-examination some laymen questioned the need of such extensive redundancy but failed to change Ontario Hydro's position on its necessity.

The security problem at the Highway 401 crossing of the Escarpment is somewhat different. The problem here is that if all four lines on this suggested route were suddenly interrupted simultaneously, it would cut off two very large generating stations from the load centres they ordinarily serve. If the production and supply of power east and west of the Niagara Escarpment were roughly balanced this would be a much less important problem. In that case the transmission lines across the Escarpment would merely serve to balance load and would carry power sometimes in one direction and sometimes in another. However, Ontario Hydro testified that, at present and in the foreseeable future, the generating stations west of the Escarpment would produce a great deal more power than would be used by the load in that area, while the power demand east of the Escarpment would greatly exceed the power production in that area. Therefore, during periods of high demand, there will be a large and relatively continuous transfer of power from west of the Escarpment to the east, so making the consequences of any interruption of this link very serious.

The question then was what kind of event could conceivably interrupt all four lines simultaneously and how often was such an event likely to happen. Human interventions, such as an air crash or sabotage, were accepted as possibilities but considered to be too remote to require any attention. Tornadoes and ice storms appeared to be the most likely causes for a catastrophe.

A panel of meteorologists was convened to give the Commission evidence on the possibility of interruption of such a line by a tornado or an

ice storm. A very brief summary of the evidence that was presented is:

Tornadoes Tornadoes normally follow a very narrow path which may be quite long. Southwestern Ontario is in an area where the frequency of tornadoes is low but still significant. Damage to hydro transmission lines by tornadoes in the past has been too infrequent to justify any statistical conclusions. Ontario Hydro did present evidence from past experience to indicate that a tornado crossing a right-of-way containing several transmission lines might well bring down all of them. The inevitable conclusion, therefore, is that a tornado could occur in the area and if it did occur it could bring down all four lines. Available frequency statistics are almost meaningless. About all that can be said is that a tornado in the area is a "once in a lifetime" happening.

Ice Storms Meteorologists gave evidence that ice storms are relatively frequent in southwestern Ontario, although it is by no means one of the worst areas in North America. There was some evidence to suggest that the high ground near Orangeville and along the Escarpment may have somewhat more frequent ice storms than nearby lower areas. While ice storms are very rare close to the lake the proposed crossings of the Niagara Escarpment are all far enough from the lake to be in an area of relatively high incidence. Ice storms tend to cover quite a large area so that separation of transmission lines by a few miles is not likely to significantly increase the security of the system. Where there are several lines in one right-of-way, ice storms by no means always bring down all the lines.

A brief summary is then that there is a definite but very small possibility of a tornado striking the lines through the Highway 401 gap in the Niagara Escarpment and interrupting all four at once. There is also a possibility that all four lines might be interrupted simultaneously by an ice storm, but the possibility of simultaneous interruption with the

four lines together is probably not much greater than if the four lines were on two or more different rights-of-way separated by only a few miles.

Bruce to Essa

A group of concerned citizens in Wellington County have strongly supported "System R" (four double circuit 500 kV lines carrying power from both Nanticoke and Bruce and crossing the Escarpment in the 401 corridor). When Bhi reluctantly abandoned "System R" because of Ontario Hydro's objections to it on security grounds, this group set out to devise an alternative plan. Briefly, they proposed that one of the three 500 kV circuits from the Bruce Generating Station should go eastward across country to an existing transformer station at Essa, just west of Barrie. This transformer station is on the existing 500 kV line from the north to Kleinburg and there is at present ample space in the right-of-way to put in another 500 kV line from Essa to Kleinburg. In the course of its study of the route from Bradley Junction to Georgetown, Ontario Hydro had already demonstrated that there is a possible route for a line to the vicinity of Flesherton, in the north-east corner of the area studied for the Bradley to Georgetown route. From there to Essa the group had not studied the route in detail but felt sure that a route could be found since the country is very hilly, relatively thinly populated and not the best agricultural land. They argued that the use of this route would greatly increase the security of the power transmission from Bruce to the Toronto load centre and would make it reasonable to concentrate the rest of the Bruce power and the power from Nanticoke in one corridor parallel to Highway 401.

This proposal received considerable popular support at the hearings. As far as the Commission knows there was no one from the area affected by the "Bruce to Essa" line at the meetings, so it was unlikely that there would have been any opposition expressed.

Ontario Hydro looked at the proposal very carefully and discussed the pros and cons in presentations and cross-examination before the Commission. Ontario Hydro has repeatedly expressed its opposition to "System R" on

both security and aesthetic grounds. During cross-examination, they did agree that the proposal would improve the security of "System R" for the short term future but felt that the "Bruce to Essa" proposal had no other advantages. In a memorandum dated November 27th, 1973, entitled 'Comparison of Power Transfer Capability and Stability of 500 kV "Systems R, Q and R-Essa"', Ontario Hydro showed that the transient stability of the Bruce Generation in 1982 would be higher under "System Q" than "System R-Essa" and that the post fault transfer capability (an important measure of system security) in 1982 of "System Q", after losing all lines in the Limehouse Speyside crossing, would be substantially greater than that for "System R" or "R-Essa" after losing all lines on the Highway 401 crossing. In addition, "System R-Essa" significantly increases the route mileage for the total system, involves an additional crossing of the Escarpment and would pre-empt part of the "Essa to Kleinburg" right-of-way which Ontario Hydro feels will be needed for the more important purpose of bringing power from a new generating station on Georgian Bay to the Toronto load centre.

Following the close of the Commission hearings, the group submitted a final paper on their proposal. Further study of the proposal convinced me that it would not be easy to find a socially and environmentally acceptable route for the "Bruce to Essa" line because it might have to traverse some of the most popular scenic and recreational terrain in southern Ontario. Since Ontario Hydro presented convincing evidence that the "Bruce to Essa" line would not produce useful improvement in the transmission system, the Commission concludes that no further consideration should be given to the "Bruce to Essa" line.

URGENCY

It is now more than two years since Ontario Hydro sought permission, from the Provincial Cabinet, to proceed with the construction of the Nanticoke to Pickering line along their selected "Middle Route". During these past two years, Ontario Hydro have initiated some interim transmission facilities by constructing additional 230 kV lines. However, they have made it clear that this has not nearly made up for the two year's delay, and that they are already seriously behind schedule on the construction of this vital link in their transmission network. If the Commission's recommendation that the route should follow the Parkway Belt is accepted, there is a very real risk that this will add further to the delays. The design of the Parkway Belt is not yet complete. It will have to be modified to include the right-of-way for the 500 kV line and will then be subject public hearings. In arriving at its recommendation for the use of the Parkway Belt, the Commission did give full weight to the possibilities of delay but has included in its calculations the conviction that all concerned will do everything possible to accelerate the approval of the chosen route and the initiation of construction. The Commission was convinced by Ontario Hydro's evidence that the time available for construction of the lines is dangerously short and that there is a real possibility of substantial financial penalties and even power shortages if construction is further delayed.

One obvious way, if at all possible, to accelerate approval is for the Government to accept the hearings of the Solandt Commission as adequate public exposure of Ontario Hydro's plans and adequate justification of the need and, therefore, have the "hearings of necessity", required by The Expropriations Act, waived in those cases where the acquisition of property by expropriation is required. The Commission strongly recommends that this be done.

Ontario Hydro's views on the necessary timetable are set out in the following quotation from their Exhibit 73-A-16:

Current optimistic schedules for constructing these lines indicates the Bruce to Kitchener line can not be available for service before October, 1976 and the Bruce to Halton line cannot be available before March, 1977. These dates are later than originally planned because of the need for greater public participation. Also to meet this date for the latter line will require:

- 1) Approval in principle be obtained for the route from Bruce GS to Halton TS within this study area by January 1, 1974.
- 2) Route approval for the Bruce to Halton TS line be obtained by July 15, 1974.
- 3) Ontario Hydro start to acquire the property from Bruce to Halton TS by October 1, 1974.
- 4) No delays due to strikes.
- 5) The Provincial Government exempt Ontario Hydro from the Planning Act.

Even with these very favourable assumptions power will be locked in at Bruce GS because of transmission delays.¹⁸

Whether or not Ontario Hydro should be permanently exempted from the provisions of The Planning Act is a complex legal problem beyond the terms of reference of this Commission. However, the Commission does recommend that any exemptions that will help to speed up the fair and orderly acquisition of land in this case should be made.

In a separate submission, Ontario Hydro estimated the cost penalties involved in delay:

The third and fourth units at Bruce Generating Station are expected to be ready for service in April 1977 and April 1978 respectively. These units are fueled by uranium which is much cheaper than coal or oil. If the 500 KV line from Bruce to the Toronto-Hamilton area is not available for the delivery of power, there will be out-of-pocket cost penalty of \$250,000 per week in respect of the third unit alone and at \$800,000 per week in respect of the 3rd and 4th units.¹⁹

Ontario Hydro pointed out that these figures refer only to the direct cost to Ontario Hydro and do not include the loss to others due to

¹⁸ Evidence for the Solandt Commission on Urgency of 500 KV lines, p. 4

¹⁹ Statement of Ontario Hydro, to the Solandt Commission, regarding Bhi Environmental Study, October 1973, p. 8

unemployment and loss of profits if any demand could not be met from other generating stations.

A 500 kV connection from the Bruce Generating Station crossing the Niagara Escarpment at Limehouse and leading to the Halton Station, from which power can be distributed through the 230 kV network, is therefore urgently needed. Every effort should be made to accelerate the approval of this section of the route. The Parkway Belt planners indicated that there were no particular problems in including the 500 kV lines in the part of the Parkway Belt from Milton to Halton, and, indeed, inclusion of the 500 kV lines in this section of the Parkway Belt was implied in the Government's policy statement, the "Parkway Belt: West", on June 4th, 1973. Accordingly, what is now needed is formal approval of this part of the Parkway Belt and of the recommended route for the transmission line from Bradley Junction to the Limehouse crossing of the Niagara Escarpment and on to the Milton Station.

I recommend that, if possible, the public hearings on those sections of the Parkway Belt which include this part of the route for the 500 kV line, should proceed even before all the "Parkway Belt West" planning is complete.

I also recommend that the Government give urgent consideration to the possibility of nominating one government ministry to acquire all land needed in the Parkway Belt, whether for Ontario Hydro and the Ministry of Transportation and Communication or for other government land users. Such centralization should accelerate land acquisition, lessen the disruption to private owners whose land is being taken and probably result in significant cost savings to the public at large. The advantages of having all the land owned by one ministry may also be considerable and are discussed on page 50.

DISCUSSION

Agriculture

No question that came before the Commission was more repeatedly or more passionately argued than whether the 500 kV line should be built over cultivated farm land or over adjacent forest, streams or recreational areas. No one argued that transmission lines should be built over Class 1 and 2 agricultural land if less important land was available. However, many environmentalists and others argued that the construction of a transmission line caused minimal disturbance to a farm but could have much more serious detrimental effects on forests, swamps, streams, etc. In the hearings concerning Ontario Hydro's "Middle Route", where the area traversed was mainly a mixture of forest and open fields, it became almost a ritual that when a farmer would say, "If you have to cross my farm, stick to the woodlots", an environmentalist would reply, "His farm is just the place for the transmission line; but keep out of the woodlots and build across the open fields".

Attempting to get further evidence on this difficult subject, the Commission held an agricultural seminar in which an effort was made to get a variety of different opinions. The Commission's conclusions from this seminar were:

- a) where possible, Class 1 and 2 agricultural lands should be avoided,
- b) when they cannot be avoided, the line should be built as far as possible along the lot lines and with the grain of the survey, avoiding diagonal severance;
- c) Ontario Hydro and others demonstrated that it is perfectly feasible to carry on almost any kind of farming operation under transmission lines. The interference with farming operations which is always present only becomes serious when very large machinery is used in large open

fields. Even in this case, the interference with agriculture is far less than that caused by a subdivision or a highway.

The total amount of land actually taken out of cultivation by a tower line is surprisingly small. For example, consider a 600 foot wide right-of-way containing single shaft improved appearance towers (base diameter about seven feet) with a span between towers of about 1,000 feet. Assuming that this will take out of cultivation a strip about 16 feet wide and 600 feet long for each set of towers, then the total loss of land will be less than $1\frac{1}{2}$ acres per mile of right-of-way or less than a $\frac{1}{2}$ acre on a typical square 100 acre farm. Experience shows that some farmers would cultivate between the towers, thus greatly reducing even this small uncultivated acreage. Others might leave a wider space around the towers. If lattice towers are used, the total area occupied by the towers increases substantially but is still a very small part of the total area.

The possibility of ill effects on both humans and farm animals due to the electrical field under the 500 kV transmission lines was extensively discussed. Ontario Hydro explained that wire fences under the line could become charged. This charge was annoying but harmless both to people and animals and could be eliminated by suitable grounding. Ontario Hydro testified that it was their practice to ground all fences under and closely adjacent to 500 kV lines. There was some testimony concerning shocks received from farm machinery under transmission lines due to static electricity. Again, these were said to be annoying or alarming but not harmful. None of the experts appearing on the agricultural panel mentioned any ill effects on the behaviour, growth or reproduction of cattle attributable to the proximity of a 500 kV transmission line.

There was some discussion of the possible toxic effects of ozone from the transmission lines on both plants and animals. It was concluded that recent studies indicated that the production of ozone by a

transmission line was so small that the concentrations reaching ground level in open country were negligible.

At the earlier hearings of the Commission in 1972, many individuals inquired about the possible effects of 500 kV lines on radio and television. They were assured by Ontario Hydro that a properly functioning line would not affect either radio or television reception. When landowners adjacent to the right-of-way suffered television interference from the line, this was due to defects which Ontario Hydro could repair very quickly after a complaint was received.

The Commission has great sympathy with the desire to maintain working farms on Class 1 and 2 agricultural lands, wherever this is possible, even close to Metropolitan Toronto. However, the Commission feels that Ontario Hydro's transmission lines are one of the lesser encroachments on good agricultural land since they do not prevent the subsequent tilling of most of the soil. The defenders of agriculture made their case to the Commission very effectively and their views have significantly affected the route selection. However, if they are to succeed in preserving active farms near urban areas, they must concentrate on ensuring that the zoning by-laws protecting agricultural areas are so specific and strong that development for housing or industry is prevented. In selecting their preferred route Bhi gave high but not absolute priority to avoiding good agricultural land. The route recommended by the Commission does the same.

In the past Ontario Hydro was accustomed to purchasing easements for long distance transmission lines. For reasons that the Commission did not ascertain, this practice gradually gave way to the outright purchase of multiple line rights-of-way and rights-of-way through or adjacent to built-up areas. During the Commission hearings, there was some discussion of the advisability of Ontario Hydro obtaining easements for or leasing, rather than purchasing, transmission line rights-of-way. To the surprise of the Commission little support for this idea

appeared although, during the panel discussion on agriculture, at least one witness expressed the belief that the loss of title to land was an important factor in the opposition of some farmers to transmission lines. In the course of his testimony, during the seminar on underground transmission, Mr. R.P.E. Watson of the British CEGB said that their practice was to lease tower sites only, leaving the owner in full possession of the intervening land, even under the wires. The following quotation from Mr. Watson's paper suggests that this practice makes the British feel more at home with their power lines:

At present there are 13,000 houses and/or their gardens crossed by lines of 132 kV, 275 kV and 400 kV in England and Wales, the very great majority of which have been built under the lines rather than the lines being built over the house.²⁰

In areas that are solidly zoned agricultural, there does not appear to be any need for Ontario Hydro to purchase a right-of-way. The Commission, therefore, recommends that in areas that are zoned agricultural, landowners be given the option of granting an easement for the transmission line rather than outright sale of title to the right-of-way. Assuming that the agricultural zoning will remain and the easement is, therefore, perpetual, Ontario Hydro should investigate the possibility of paying an annual rental for the easement rather than outright purchase. If the annual rental were re-negotiated, say every ten years, this would give the landowner some compensation for inflation and rising land values.

Ontario Hydro's Ecological Practices for Rights-of-Way

During the Commission's initial hearings in 1972, it was obvious that the public anticipated the clear cutting of all selected rights-of-way with little or no subsequent landscaping or restoration. At those hearings, Ontario Hydro presented a description of new policies for selective cutting, restoration and multiple use of transmission line rights-of-way which had been adopted in 1971. These practices will

20 CEGB Experience and Practice in Use of E.H.V. Underground Transmission for Amenity Reasons. R.P.E. Watson, October, 1973. p.4

greatly lessen the environmental impact of transmission lines and should be fully understood by everyone who discusses this impact. These new practices are of such great importance that they are described in considerable detail by quotation from Ontario Hydro's own submission of July 31, 1972, to the Commission.

6.1 New Ecological Practices

Ontario Hydro recognizes that the establishment and maintenance of high voltage transmission facilities has an effect on the total environment. (...)

(...) Ontario Hydro has gradually changed its right of way cutting and maintenance policies in order to minimize the ecological impact of its transmission rights of way and to blend these facilities more harmoniously into the surrounding landscape.

Selective cutting was begun in 1971 while selective vegetation management has been practised for several years.

6.2 Planning Phase

Once the transmission line route has been chosen but before any cutting is carried out, a selective cutting plan must be prepared and approved.

6.2.1 Selective Cutting Plan The selective cutting plan covers four major aspects of the right of way as follows:

a. The Ecology - Standards and Specifications

All of the ecological data which is gathered prior to route selection will be reviewed, updated and transformed into standards and specifications. These must be adhered to during construction, restoration and subsequent maintenance of the right of way. The standards will outline procedures in six general areas of concern.

- the existing ecological condition of the new right of way
- possible areas of ecological damage

- standards and procedures to limit any damage
- standards and procedures to rectify any damage which might occur during construction
- explanation and definition of any possible irreparable damage
- maintenance standards in order to maintain natural balance

These studies and the subsequent standards will be the responsibility of a team of highly qualified earth scientists (Biologist, Forester, Soils Scientist).

b. Selective Cutting

The right of way will be surveyed to assess the topography and vegetative cover to determine the least cutting necessary. This part of the plan will include the following:

- minimum size and cutting for tower sites
- location of access roads for construction and maintenance so that minimum cutting is required and any damage to topography will be minimal
- determination of areas where trees can be pruned or left entirely
- determination of trees that have to be removed
- determination of particularly sensitive areas such as road and water crossings, pond and swamp areas where extreme care must be taken

c. Restoration Work

The survey of the right of way will also determine any restoration work to be carried out after the construction of the line. The plan will include the following:

- any tree planting necessary at the sensitive areas stated above in addition to the trees left through selective cutting
- location of areas on or adjacent to the right of way to be reforested under the reforestation policy (...)

- location of areas to be seeded with grasses and legumes
- location of areas where it will be necessary to install and later remove temporary culverts required for construction; to restore fences and carry out any necessary grading

d. Potential Uses

The survey of the right of way will note any areas that could be used for other purposes in addition to the transmission of power. (...) These areas will be marked on the plan as well as noting any parts of the right of way that have been leased back and any special cutting or other agreements that have been made with adjacent owners or others.

The selective cutting plan thus forms a specification for the cutting and restoration to be carried out and also provides a historical record of any work that is performed on the right of way.

6.3 Construction Phase

The selective cutting necessary for the right of way was detailed in the selective cutting plan. This work is carried out during the construction phase by qualified personnel under direct on-site technical supervision.

6.3.1 Selective Cutting The process of selective cutting involves the removal from the right of way of only those trees that interfere with the construction and safe operation of a line.

There are certain factors which affect the number of trees that can be left such as age, height and species of trees in the woodlot, the location of towers in relation to the woodlot, the point of maximum safe clearances for line conductors. (...) The required clearance of 500 kV conductors above ground is 35 feet and the minimum clearance between a tree and a conductor must not be less than 15 feet.

On level terrain directly under the conductors at point of maximum sag (usually at mid-span), a tree 20 feet in height would provide the necessary clearance. The height of trees that could be left directly under the conductors would increase from 20 feet to approximately 40 feet in the vicinity of the tower. Toward the side of the right of way

and in valleys or depressions, trees of greater height may be left. Trees in certain situations can be pruned rather than removed as long as the tree is of a type suitable for pruning.

Large forest type trees, which cannot be pruned to maintain their natural form, would, if appropriate, gradually be removed to be replaced by a species more compatible with overhead lines. A list of 56 such species has been developed for such use.

Special care will be taken to leave trees at road and water crossings, in areas with a pond or spring, or other sensitive areas such as conservation or reforestation areas. Trees left of the right of way will be pruned regularly to maintain the necessary clearance. Where more than one line is to be constructed on a right of way over a period of years, only one line will be cut at a time.

Every effort will be made to maintain the natural topographic features of the woodlots through which the right of way passes.

6.4 Restoration Phase

After the construction phase is completed, the restoration work that was determined in the selective cutting plan will be carried out by qualified people under direct on-site technical supervision.

6.4.1 Screen Planting Where possible during the process of selective cutting, trees will be left to assist in blending the right of way into the surrounding environment. It is impossible to hide towers or conductors with trees but they do provide another point of focus for the eye.

Trees will be planted at sensitive locations where there are no trees to leave or where the number left are inadequate to screen. In addition, to help screen the facilities from immediately adjacent property owners, trees may be planted where appropriate, either on the right of way or on the adjacent property owner's land.

The trees will be of appropriate species for the soil conditions and will be similar to the natural vegetation growing in the vicinity. Where trees are planted immediately under the line, they would normally be of a species that, at maturity, would

not grow within 15 feet of the conductors. If trees of a larger growing habit are planted, they will be pruned periodically to maintain the necessary clearance.

Advanced tree moving equipment will be used which can plant trees from 10 to 35 feet in height.

6.4.2 Cover Crops The construction of a transmission line requires that certain trees be removed to give clearance to the conductors, to give working areas for placing the footings, erecting the towers and providing access to these areas. The above areas are also those that will be required for ongoing maintenance of the line and right of way. Such locations will be seeded to various mixtures of grasses and legumes. This seeding provides a ground cover to help preclude the re-establishment of woody growth and weeds, to give food and shelter to birds and other wildlife and to prevent erosion, and in turn, stream sedimentation. (...)

The objectives of the cover crop program are to control biologically the undesirable woody growth that, if unchecked, would reach the conductors, to control weeds and erosion, and to enhance the rights of way from a wildlife point of view. Most wildlife prefer that area along the borders between open lands and forested lands. This so-called "edge effect" will be improved by the use of cover crops. Studies are being carried out in co-operation with the Wildlife Branch of the Ministry of Natural Resources, in this regard.

6.4.3 Shrubs We are co-operating with the Ministry of Natural Resources in the selection and seeding of appropriate shrub cover which will provide competition for undesirable fast-growing tree species which could present potential security problems to the line. This shrub cover will also be attractive to birds and small game for food and shelter. (...)

As more experience is gained, shrub seeding will become a regular part of the restoration phase.

In addition to the experimental seeding, the Wildlife Branch of the Ministry of Natural Resources is managing selected areas of the Nanticoke and other rights of way as a demonstration of the use of shrubs to provide a biological control for undesirable woody growth and to provide food and shelter for birds and small game.

6.4.4 Reforestation For a number of years, Ontario Hydro has been carrying out an annual reforestation program across the Province.

This program will now be expanded so that in townships with less than 15% of the farm area in woodlots, for every acre of woodlot selectively cut for the construction of lines, an equivalent acre of land may be reforested with seedling stock. The land to be reforested will be in one of the following categories:

- a. Suitable land on the right of way or on property adjacent to the right of way that the owner wants reforested by Ontario Hydro.
- b. Land necessary for Ontario Hydro to acquire in addition to its specific right of way requirements.
- c. Land designated by the Ministry of Natural Resources, Township, County, or local Conservation Authorities.

Ontario Hydro will either plant the equivalent acreage or co-operate with the above groups in a planting program. The selection of species used to reforest would take into account such factors as soil conditions, the existing vegetation in the locality, and the needs of birds and small game. The appropriate property owner would be responsible for maintaining the reforested areas on private, government, or conservation lands.²¹

Multiple Use of Rights-of-Way

At the earlier hearings, the public automatically assumed that Ontario Hydro would continue in the future to discourage the use of its rights-of-way for any purpose other than the transmission line. However, Ontario Hydro testified that they were very keen to encourage multiple use of their rights-of-way. Their policy in this matter is set out in the following quotation, again from their submission of July 31st, 1972:

The primary function of the right of way is and must remain the transmission of power with full regard to the safety and service reliability. Ontario Hydro, however, proposes to permit alternate uses of its rights of way providing such

²¹ Op. cit., p. 37-41

uses are compatible with the surrounding communities, with local zoning and official plans.

Ontario Hydro will co-operate to the fullest extent where more than a single use is indicated and appropriate so that the right of way will enhance the area and complement the existing natural topography.

In addition, there may be some instances where the land owner wants a wood lot turned into pasture or crop land rather than being selectively cut. Such requests would be considered by Ontario Hydro.

A wider spectrum of agricultural uses will be encouraged if appropriate, such as turf farms, market gardens, orchards, small tree plantations, and nurseries.

Park and recreational areas may be developed on the right of way if mutually acceptable. Some such uses are walk or sit-in parks, riding trails, hiking trails. Ontario Hydro is now co-operating with the Ministry of Natural Resources in assessing the feasibility of linear parks.

Where the right of way passes through industrial and commercial areas, non-rural uses will also be considered.²²

During cross-examination Ontario Hydro indicated that their usual policy was as follows:

If farm lands are involved, Hydro will license back to the former owner for farming, any land within the right-of-way area, which is not immediately required for construction, at the sum of \$1.00 per acre per year, plus a sum equivalent to the taxes. A license for farming purposes may be arranged either on a yearly basis or over a longer term, as required.²³

In the case of agricultural land that has been in use, Ontario Hydro will restore drainage fences, etc. so that the land will be fully useable except for areas occupied by the tower bases. Where the original owner is not interested in continuing to use the land, Ontario Hydro is willing to entertain proposals for other uses. These other uses will be considered in cooperation with both the municipality

²² Ibid., p. 49

²³ Ontario Hydro: Property Policies and Practices, November, 1973, p. 5

and adjacent landowners, in order to try to encourage land uses that fit in with municipal plans and are not unpopular with adjacent landowners.

Since a great deal of the proposed right-of-way for this route, from the Milton Station to the Cherrywood Station, will be in the Parkway Belt, most of it should be available for other uses. Especially with selective cutting, the right-of-way will be highly suitable for many recreational uses.

This new policy on multiple use of rights-of-way will undoubtedly convince the public that transmission lines do not have the same adverse effects as expressways and railways. Transmission lines neither preempt the total area nor do they interfere with highway and pedestrian crossings in the same way. In fact, it will appear that the main disadvantages of a transmission line are visual.

Ontario Hydro's Land Acquisition Policies

During the earlier hearings of the Commission in 1972, Ontario Hydro presented detailed evidence concerning their land acquisition policies. They stated that less than 1% of their land acquisitions were by expropriation. In all other cases a satisfactory settlement was negotiated with the owner. When expropriation is necessary this is done under the provisions of The Expropriations Act of Ontario. This Act has recently been revised and now appears to give very good protection to the landowner whose property is being expropriated. The one provision of the act that was questioned by many was that no compensation would be paid to owners of property adjacent to a transmission line right-of-way unless part of their property was actually taken. For those interested in further details, Ontario Hydro has a booklet entitled "Property Policies and Practices".

During the early hearings of the Commission, there were several lively debates concerning the effect of rights-of-way on the value of adjoining land. Without exception, those who cross-examined Ontario Hydro were

convinced that the construction or even the threat of construction of a transmission line depressed the value of adjacent land. The only evidence these individuals presented to support this view was based on their discussions with knowledgeable local real estate agents. Registry offices contain historical data on land sales that would, if collected and analysed, throw some light on this problem, but neither side mobilized this evidence. Ontario Hydro did present one report which showed that, in one area, people had been willing to buy land close to an existing transmission line in order to build expensive houses. This is an interesting observation but it does not throw much light on the larger problem. Curiously, there seemed to be a general consensus that an adjacent transmission line right-of-way would probably increase the value of land in an urban or high density residential development.

Public Participation

The history of the Commission is a story of growing public participation in selecting a route for Ontario Hydro's new 500 kV transmission lines. Based on its previous experience, Ontario Hydro had proceeded with their planning in consultation with the municipalities and had every reason to suppose that after these discussions there would be no serious opposition to the route other than from individual landowners who were directly affected. Instead, public reaction to the proposed route was sufficiently vigorous to result in the formation of several citizens groups and the submission of petitions to the Premier of Ontario, the Honourable William G. Davis, which led him to appoint this Commission.

The first series of public hearings of the Commission, during 1972, consisted entirely of hearing submissions from and listening to cross-examination by a variety of citizen groups. It became clear from these hearings that the citizen groups felt they had an important role to play in the process of selection of a route. Therefore, when Bruce Howlett was selected to do the further study he was instructed to involve citizen groups at the earliest possible moment. The Bhi study and the subsequent hearings, therefore, became an experiment in public

participation as well as a planning effort. Unfortunately, there was no time available to do a systematic study of past experience of public participation in planning of this kind in order to make the most effective use of past experience. Nonetheless, there was a good deal of professional input to the plans for the hearings both from Bhi and their public relations consultants and from Ontario Hydro, based on their previous experience.

The Hearings on Ontario Hydro's "Middle Route"

In the hearings concerning the "Middle Route", citizen participation was active and effective from the beginning because the citizen groups who had asked for the hearings were anxious to present their case and to cross-examine Ontario Hydro. It is interesting that, even before they appeared before the Solandt Commission, the citizens that did appear had divided into two groups which had somewhat different motives and goals.

The first group were exemplified by The Coalition of Concerned Citizens and several other smaller regional based groups. These were composed of people who were quite directly affected by the transmission line, either because their properties would be involved or because their view or some other amenities of their properties would be adversely affected. The approach of individuals in these groups varied from those who bluntly declared their interest and said that they were not opposed to transmission lines in general but just to a line on their property, to those at the other end of this particular spectrum who emphasized the adverse environmental effects of the proposed line and only mentioned in passing that it crossed their property or would block their view. All these groups were geographically based and would presumably not have appeared to challenge a transmission line routing that was remote from their living area.

The second group were the "environmentalists", represented by the Sierra Club of Ontario, The Conservation Council of Ontario, The Federation of Ontario Naturalists, et al. Their goal was to try to

ensure that essential transmission lines were located where they would cause the least environmental damage. They presumably would appear to question transmission line routes wherever they were located. Their concern was not with any particular local geographical area but rather with the overall preservation of the environment.

Almost lost among these predominant groups were two smaller ones that had very few spokesmen. One of these consisted of a small number of farmers who would be quite willing or even anxious to have their property crossed by the transmission lines. They could see definite economic benefits from the line and were not averse to the environmental effects. The other group, possibly larger but not vocal, included those who said that Ontario Hydro should unilaterally decide where the route could be built most quickly and cheaply and get on with the job. A few of these even said, "If it crosses our house, that's too bad. We will move somewhere else."

Discussion with municipal officials during this period indicated that there was much division within individual municipalities. There was a tendency for the authentic country people to favour the building of the transmission line because they believed that it would have a beneficial effect on economic development and would provide them with the possibility of better jobs and more cash income. On the other side, were the rural estate dwellers, relatively wealthy people recently come from the city, who were intent on protecting the rural environment and their own property.

Faced with the conflict between these groups, several municipal politicians remained firmly on the fence, refusing to take sides. As was obvious in a few cases, this resulted directly in the formation of citizen groups who took their case over the heads of the municipal governments to the public and to the provincial government.

The experience of public participation at these hearings was used to guide the planning for involvement of the public in the later meetings during the Bhi study.

The Bhi Study

The Commission has felt that effective public participation is best fostered by having the public involved in the planning process from the very beginning so that they can comment on how the planning is being done and contribute their input at each stage as it progresses. It is felt that public participation should be limited to making certain that the points of view expressed by the public are understood by the planners and considered by them in formulating their recommendations. Important views, especially those that are not supported by the planners, must also be passed on to the political decision makers.

In the final analysis, the decisions on the location of a major transmission line must be taken by the Provincial Cabinet as the elected representatives of the people, and no members of the public can directly take part in decision making at this stage. The best that public participation can ensure is that inputs from the public do reach the members of Cabinet in an intelligible form and are explicitly considered by them in reaching their decisions.

It was, therefore, decided that an effort should be made to involve the public in the Bhi study from the very beginning, even before the consultants began to form their own views. This decision posed the first problem; how to get in touch with the interested public? The possibility of individual mailings to every landowner in the area was considered and quickly dismissed because the cost for a single mailing to the population of the study area would be of the order of \$50,000. Various possibilities for providing selective mailing lists were considered but all were rejected. Finally, it was decided that advertisements in metropolitan and local newspapers, together with mailings to all municipalities and agencies such as conservation authorities and, lastly, the use of the Commission's already established mailing list would be the best way of getting reasonable contact with the public at acceptable cost. One disadvantage of this decision was that the Commission's then existing mailing list had a strong geographic bias in favour of those who lived along Ontario

Hydro's original "Middle Route" and who had participated in the earlier hearings. It was some time before new additions from other areas provided a more representative mailing list.

The next problem is: having got a section of the public to attend a meeting, what kind of input can be expected from them? Two obvious kinds of input require very little discussion. The first is that of detailed factual knowledge received directly from the residents in each area, about local environmental problems and conditions. The second input is the expression of opinion, especially on non-technical problems such as whether transmission lines should be located along roadways or not.

Obtaining worthwhile opinions on technical options presents much more serious problems. For example, what good is it to ask a non-technical audience whether Ontario Hydro should use 500,000 kilovolts or 750,000 kilovolts as the basis for their major transmission corridors? Any average audience would require at least several hours instruction on the pros and cons involved before they could give an intelligent opinion. Even then, the opinion they gave would be very largely coloured by the views of their instructor, who would almost certainly reveal a bias in favour of one or other alternative. The listeners would then make their decision really on the basis of whether they were prepared to accept the instructor's view or reject it because they felt it was being imposed upon them.

The problem of trying to educate a public audience in order that individuals can make intelligent choices is further complicated by the itinerant nature of audiences. The total number of individuals that attended every hearing of the Solandt Commission was probably less than five. There might have been as many as fifteen people who attended 80% or 90% of the hearings. At the other end, probably 50% or more attended only one or two hearings and these, consequently, were always "new boys" who did not know the background of the subjects being discussed. Often, these latter either got little out of the discussion

or expressed naive or ill-considered views to the occasional irritation of the "old hands".

How then, can citizens participate effectively in planning; or, to put it the other way around, how can planners effectively include the results of citizens' participation in their plans? In the present case, Bruce Howlett and his staff, and later the Commissioner, read submissions and, together with public cross-examination and discussion, tried personally to interpret a distillation of all of these views into a set of final recommendations. This is obviously a very subjective way of inserting public influence into decisions and it would be highly desirable to have some quantifiable index of citizen views. At least three techniques for doing this are frequently discussed. These are petitions, questionnaires and referenda.

The petition is a familiar political tool used by special groups to express their views to political authorities. If each signatory has carefully considered the substance of the petition and signs only in the light of full knowledge and conviction, then the petition can be a very useful indication of public opinion. Unfortunately, the petition is very open to abuse. Many people will sign a petition that is against anything. Some do not even ask what the petition is about as long as they are sure that it complains about some grievance. Because of these obvious difficulties, petitions must be viewed with some caution.

The questionnaire has been highly developed in recent years as an instrument of research on public attitudes to a wide variety of questions. If it is to yield statistically significant results, a questionnaire must be very carefully prepared and must be directed to and answered by a carefully selected and instructed sample of the public concerned. Particular care must be taken to ensure that the group who respond is representative of the total population being studied.

Unfortunately, when questionnaires are distributed at public meetings, as in the case of the Bhi study, there is no way of controlling the

composition of the group who respond or even of fully understanding the way in which the group has selected itself. Even the most cursory study of the results of the Bhi questionnaires indicates that the results should be treated with great caution because the returns were heavily weighted by a variety of factors. When carefully interpreted by an experienced environmentalist, the replies to the questionnaires undoubtedly produced some valuable indication of the way the public was reacting to the routing problems, but any attempt to attach quantitative significance to the result is worthless.

The mechanism of the public referendum is used in many countries for settling problems of this kind. It has very attractive possibilities but, to be successful, must depend on education of the voting public. Where the referendum is on a political issue, the voter is usually given highly biased view points by the opposing parties. In this way he will at least hear both sides of the issue and might in total get a reasonably balanced view. Curiously enough, it would appear to be very difficult to achieve a similar balance on more technical questions, such as the location of a transmission line. The individual voter can only give an intelligent response to questions on the location of a transmission line after he or she has been carefully instructed on the alternatives that are available. Here again, the problem is to find someone who can give dispassionate and unbiased instruction in the subject which will be accepted as such by all concerned. A referendum also is valueless if only those who are directly involved in the issue vote, since their attitude to the problem will clearly be quite different to those who are not directly affected.

Transmission lines could well provide a dramatic illustration of this problem. If each time a route was selected a referendum was held and only those who were directly affected by the selected route were permitted to vote, it is hard to believe that any referendum would ever favour the construction of the proposed line. Thus this technique would make it impossible to build new transmission lines anywhere.

All this sounds very negative since it dwells primarily on the

difficulties of achieving effective citizen participation. Nonetheless, in spite of all these difficulties and in spite of the fact that this was a very early attempt to involve the public, the public did have a very substantial influence on the contents of the Commission's Interim Report, of the Bhi study and of the Commission's final recommendations. Many individuals made a valiant effort to participate, often at great personal sacrifice, and they can feel satisfied that their efforts were worthwhile. However, it should be possible to do better another time and the following suggestions are offered for consideration in arranging for public participation in future community and regional planning projects.

- 1) A great deal more time must be allowed for effective citizen participation.
- 2) Public participation in planning must be specialized so that a small group of interested citizens who represent the rest can take the time to become knowledgeable in a particular field. This is probably best done by having continuing citizen organizations, at the municipal or local level, that will appoint representative groups to deal with each new issue as it arises.
- 3) Early public meetings should be entirely educational, aimed at giving everyone concerned a common basis of factual knowledge and understanding on which to base their judgments. The technique of the seminar which was used during the Commission's latter hearings, on issues such as undergrounding, worked very well and should be considered for future use in suitable cases. In other cases a simple lecture by a well qualified and lucid authority will be valuable. In cases where there are known to be opposing view points, it is essential that proponents of both sides appear during the educational phase.
- 4) After the educational phase comes the exploratory phase, during which alternative solutions to the problems being

considered are presented and debated. During this phase, efforts should be made to achieve a consensus on most of the controversial elements in the problem and to define clearly the remaining issues.

- 5) The next phase is that of an effort to quantify the public input. This will involve the discussion of weighting of various factors, the completion of questionnaires and in some cases a referendum among a carefully selected population. If the representatives who attend the meetings regularly are widely representative of the population concerned, then questionnaires completed by them may be adequate. However, in many cases, if quantification of opinion is felt to be necessary, it will be important to have the questionnaire completed by a carefully selected sample of the population. Many of those selected in this sample will not have attended meetings and this poses a further educational problem.
- 6) Meetings related to the function of such a Commission as this should be divided into two categories. In the first category, there are general educational meetings and purely local meetings where the individual citizens should be encouraged to ask questions and make comments. The second category is that of the more formal hearings of the Commission. At these, citizens wishing to participate should be required to provide, in advance, written briefs which they intend to present at a session of the hearings and on which they would be subject to cross-examination. General public discussion at the more formal hearings appeared to have a very low cost-effectiveness. The same input can be made in far less time if the presentations are better organized.
- 7) Written opinions from the general public should also be encouraged, in order to broaden the sample of opinion. It must be made clear that negative and apparently selfish reactions are as much worth recording as any others. Unless everyone speaks up it is theoretically possible to build a

transmission line where no property owner wants to sell while an adjacent route where everyone would like to sell is left unused.

Citizen Committees

Bhi also experimented with the formation of small specialized committees of private citizens to investigate and report on specific subjects. Two such committees were established, one on the design of transmission towers and the other on station design. In each case, the members of the committee were volunteers who came forward to offer their services. All were people who had attended the public meetings regularly. For each committee an arrangement was made whereby they could get detailed factual information directly from Ontario Hydro. Details of the work of the committees are contained in the Bhi Report.

The Citizens' Committee on Tower Design met frequently and presented a very lucid and useful report. With relatively minor alterations, their main recommendations have been carried through into the Bhi Report and the recommendations of this Commission. On many points, the conclusions reached by the committees did not differ widely from the views of Ontario Hydro. I believe, however, that the interaction between the citizens and Ontario Hydro, provided by the forum of the committees, did very substantially alter the emphasis of some of Ontario Hydro's views. For example, Ontario Hydro began, in the initial hearings in 1972, by advocating single circuit towers in almost all locations. In their final discussions with the Commission, they had tacitly accepted the obvious citizen preference for double circuit towers even though these were taller. Both committees put greater emphasis on improving the appearance of both transmission towers and stations than Ontario Hydro had previously done.

The committees certainly had a very beneficial effect on the relationship between Ontario Hydro and the public. The members of the committees were able to reassure other citizens that they had looked in depth into the specific problems and felt satisfied both with Ontario Hydro's progress

and its judgments. Where ever the group of citizens participating in any particular study is small, fairly coherent and attends regularly, the committee technique has obvious possibilities for providing an effective forum for education and dialogue and for reaching a consensus.

Scale and Cost of Public Inquiries

The Commissioner has been unable to discover any established rules for determining in advance the appropriate scale and cost for a public inquiry. In most cases this seems to have been determined by a complex interaction between the nature of the problems being studied and the attitudes of the particular commission. Some day a diligent historian will do a study of the cost-effectiveness of public inquiries with results that will certainly be startling.

In the present case the initial problems seemed to be relatively simple and, in addition, the Commissioner has a strong personal bias against the proliferation of bureaucracy. Therefore, this has been a mini-commission and the total staff has never exceeded four including the Commissioner. Even the use of consultants has been quite limited. The Bhi study has been conducted very frugally. The Bhi staff was small but expert; they made the greatest possible use of the assistance of Ontario Hydro and other government ministries; and the study was done with amazing speed - all factors that reduced the cost.

Criticism of the work of the Commission by the public has so far centred almost entirely on sins of omission not commission. Correcting even a few of the deficiencies that have been criticized would have at least doubled the cost of the Commission. In spite of all these facts, the direct cost of the entire inquiry has been approximately \$380,000.00. This does not include most overhead costs nor expenditures by Ontario Hydro and other government ministries. It can certainly be argued that this money has been well spent if the planning for a project that will ultimately cost over \$300 million has been substantially improved. The real difficulty is to know whether the final decision will be wiser because of the expenditure and, even more difficult, is the question

whether it would have been even wiser if the Commission had spent twice as much or ten times as much.

The view of the Commission is that the scale of activities by Commissions and their staffs should be kept to the minimum that is consistent with doing a reasonably good job. Perfection, especially in public participation, staff work and reporting is certainly not worth the cost. Achieving the last few per cent in approaching perfection may easily double the total cost.

The main problem with any Commission that deals predominantly with questions that depend upon the ready availability of a large data base is to ensure that the needed data are available, properly digested and portrayed, to facilitate decision making. In this case, both the Commission and Bhi were amazed by the poor availability of even the most obvious information on land use. The experience of the Commission strongly supports the need for a centralized agency to collect and keep up to date a complete inventory of land use in Ontario. In future, as techniques improve, this data base could be computerized so that any group studying a specific land use problem could very quickly and cheaply get print outs of all the information it needed. There is no other single factor that would so greatly reduce both the need for and the cost of future commissions as would the creation of this central data base.

The Future of Long Distance Transmission

A surprising number of those who appeared before the Commission suggested, insisted or demanded that the entire 500 kV line should be put underground. When told that this would be difficult, expensive and unreliable, they were at first incredulous and then exasperated or downright angry. They felt that with the backing of modern science the engineer could do anything that he was asked to do. Some suspected and a few even accused Ontario Hydro of deliberately misrepresenting the situation. This reaction is quite understandable but is so important that it deserves some examination and comment.

The first comment is that Canadians have been surprisingly late in developing a sensitivity to environmental amenities. It is only recently that we have been prepared to pay for having electric power and telephone transmission cables put underground, even in our cities. It is only in the last very few years that there has been any pressure to put major long distance transmission lines underground in rural areas. Consequently, utilities like Ontario Hydro have not given high priority to the problems of undergrounding long distance high voltage high capacity transmission lines. Ontario Hydro has in fact an excellent record of being in the lead in all technological innovations, not only in those that reduce cost or improve service but also in those, such as underground cable, which affect both the environmental impact and the function of electrical systems. What then can Ontario Hydro effectively do in response to this new public pressure? The simple answer is that there is nothing that Ontario Hydro can do to change the situation quickly. Ontario Hydro is an immense energy conversion and distribution system. It has a capital investment of approximately \$6.5 billion in its plant. Each individual customer considers himself to be very important and urgently needs cheap and dependable power. Thus, for both economic and social reasons, Ontario Hydro cannot introduce into its operating system any innovations that are not fully tested and certain to be reliable. In addition, these innovations must be completely compatible with the existing system, since it is not

possible to envisage shutting down the system for a few months to change over to, for example, a greatly improved distribution system.

Furthermore, research, development and testing on the scale required to produce innovations of proven dependability to go immediately into service in a large system are extremely expensive and slow. As a result, no one utility can afford to do a comprehensive range of development to meet all its own problems. Therefore, the evolution of really new equipment for electric utilities proceeds on what appears to the ordinary citizen to be an almost geological time-scale.

The range of options that has opened up just in the field of long distance power transmission is bewildering. Among those that were described in more or less detail to the Commission were substantial improvements in existing cable technology including plastic sheaths, better insulation and a variety of internal and external cooling systems. Next came the so-called spacer gas system including, particularly, SF₆ (sulphur-hexafluoride) and DAMUT (ducted air medium underground transmission). Sulphur-hexafluoride is a very stable gas with highly desirable electrical properties which is already being used as insulation in high voltage switch gear and bus connections within the transformer and switching stations. Its use promises to reduce the size of these stations many fold. The development of this equipment is largely in the hands of manufacturers, mainly in Europe. Ontario Hydro participates actively by buying the latest "state of the art" equipment. The DAMUT system is an attempt by Ontario Hydro to use the same principles, but with air rather than sulphur-hexafluoride as the insulating agent. The project is, at present, very promising but development is so far limited to 230 kV and it could be some years before even this is fully tested.

Direct current transmission is on the verge of major developments. It has long been known that direct current lines, whether overhead or underground, were smaller and cheaper than alternating current lines of similar capacity, but it is not easy to change voltages in DC systems and so equipment is needed to convert from AC at the generators to DC

for the transmission lines and back to AC for local use. Until recently the rectification equipment was expensive and complicated. Recent developments in solid state physics are already beginning to result in much cheaper and more reliable equipment for interconnecting AC and DC lines. Here again the slow process of evolution is proceeding, with Canadian utilities and industry playing a leading role while Ontario Hydro watches closely.

Another area of great promise is in the use of cooled cables. When cooled to the temperature of liquid nitrogen, underground cables have very low resistance and, consequently, very high carrying capacities. With still further cooling, certain alloys lose all electrical resistance. This property is the basis of the so-called super conducting cryogenic cables. All of these and other possibilities are promising. All are being developed by one or more industries or utilities but their penetration into the operating systems of the utilities will undoubtedly be slow.

In addition, there are many individuals who question the advisability of continuing to distribute energy in the form of electricity to individual homes and factories. There are strong arguments for having large central nuclear power plants producing either hydrogen or some simple hydro-carbon which would then be distributed by underground pipeline to individual load centres such as homes or factories. In the ideal system, each home or factory would have its own fuel cell which would produce heat and electricity locally. The efficiency of the fuel cell is so high that waste heat could safely be discarded into the air locally. The other waste products would be water and carbon dioxide. Obviously these possibilities must be examined carefully because if among them is the route of choice for our energy rich society, then we should divert effort into it rather than pursue the further refinement of electrical distribution systems.

The fundamental problem is that we do not yet have in our society any institutions designed to bring the best of our science and technology to bear on problems like this in an intensive and continuing way. There

are difficulties at every level of the social system. Few scientists like to spend their lives pursuing new knowledge in one limited area. Nearly all of them prefer to explore new areas where promising leads appear. Even when the fundamental science needed for a new advance is available, major difficulties remain. The total investment in existing system such as our electrical generating and distributing system, is so great that it is difficult to envisage a major change, especially to a system that is incompatible with the existing one. Governments are elected for four or five year terms and find it difficult to justify a major expenditure on projects that cannot possibly mature for ten or fifteen years. Past experience indicates that if one government does channel major technical effort into meeting some foreseen future need and is then overthrown at the polls, its successor may well stop the program partly at least because it is liberal or conservative rather than merely good or bad.

The perfection of the Candu reactor took almost 30 years, roughly from 1943 to 1973. During most of this time it was under constant attack by both politicians and engineers. Fortunately, through the perseverance of a few individuals the project survived and has resulted now in the world's most successful nuclear reactor. But, unfortunately, it looks as if the work will stop there because, instead of reinforcing success, we are resting on our laurels.

Most Canadians do not realize that the pressurized and boiling light water reactors being made in the United States represent the end of a particular branch in the tree of development. On the other hand, the Candu reactor is just the beginning of quite an important new branch. The next step along the branch has already been demonstrated in the organic liquid cooled heavy water reactor that has been operating so successfully at Pinawa near Winnipeg. The next stage is the introduction of thorium into the core of the Candu reactor. By doing this, the efficiency can very closely approximate the breeder reactor that may follow at a much later date. These promising means of meeting future energy needs, not only for Canada but for the rest of the world,

are right at our fingertips and yet the Federal Government decided not to finance the construction of a larger organically cooled heavy water reactor and virtually nothing is being done on the use of thorium in the Candu reactor.

Here then is a classic example of a nation that foresees continuing energy problems in the future, not only for itself but for all the other highly industrialized nations. We have in our grasp the means for making a major contribution toward the solution of these energy problems and yet we are not directing nearly adequate resources into them. I have illustrated the theme with a Canadian example, but the same criticism can be levelled against most other national governments. For example, the United States government has known for many years that it could only achieve self-sufficiency in energy supplies in the near future by the use of its vast reserves of coal. The science needed for converting this coal into oil and gas has been available for many years but the U.S. government has refused to make the investment in engineering development needed to convert this science into an operating system. A few hundreds of millions of dollars spent in this direction over the past twenty years would have ensured the self-sufficiency of the U.S. today. Unfortunately, the goal was never clearly defined and the money was not spent.

Although it is outside the immediate terms of reference of the Commission, I would strongly urge that the Federal and Provincial Governments, as part of their program to coordinate action on energy problems, define Canada's goals for new technology needed both for the generation and transmission of power over the next twenty to thirty years and then immediately implement and adequately fund programs to ensure that these goals are achieved. It is not necessary to do all the research work in any one province or even in Canada. What is necessary is to ensure that all the major developments required are in hand somewhere and are being adequately funded and coordinated. Canada already has substantial resources on which to build in Ontario Hydro, Hydro-Quebec, the National Research Council and industry. With proper

planning we can more than pull our weight in international efforts to devise better energy supply and distribution systems.

Communication with the Public on Land Use Planning

The experience of the past two years shows that Ontario Hydro will, in the future, be continually faced with the need to communicate with the public concerning future projects. In addition, the new Planning and Development Act provides for extensive dialogue between government officials responsible for new land use development plans and the public, prior to government approval of these plans. It is because of this growing need for effective communication between both Ontario Hydro and government officials and the public that I have included this section in the report.

During the initial hearings of the Commission in 1972, the Commissioner and staff dealt principally with officials of Ontario Hydro at all levels and had comparatively little contact with provincial government officials.

Mr. G. E. Gathercole, Chairman of Ontario Hydro, and several of his senior officers appeared personally at the first days of the hearings and helped greatly in getting the sessions off to a good start by their frank and open statements about Ontario Hydro's plans. In spite of these beginnings, Ontario Hydro's staff who were subsequently cross-examined on the Ontario Hydro "Middle Route" were obviously very nervous about talking to the public. Their unwillingness to give a direct answer to a simple question often both amazed me and irritated the audience. However, after a little practice, most of the Ontario Hydro senior staff relaxed and found that the public's questions were sincere efforts to get information and were intended to be neither devious nor "loaded". They found that the questioner looked for and was satisfied with a simple direct answer, and quickly discovered that it was much more effective to say, "I don't know, but I can find out and give you the answer", than to say, "I can't tell you the answer". Even the answer, "I am not at liberty to comment on the policies you are questioning" was accepted, though not always cheerfully.

The relationship between the public and Ontario Hydro, as seen at the Commission's 1972 hearings, improved immeasurably throughout these hearings. Both the Commissioner and the public gained the clear impression that the Ontario Hydro officials who appeared were honest, competent, intelligent people who had a better than average knowledge of their job, were willing to discuss it with the public and would change their position when presented with new ideas or new information.

Later, when the Commission had need to deal more directly with Provincial Government Ministries concerned with land use planning and when Bhi began to assemble the data needed for their analysis, a similar, uneasy reaction was encountered. When, later in the 1972 hearings, civil servants of ministries came to appear before the public they were even more uncommunicative. It appeared that this unwillingness to talk freely stemmed from at least three causes:

- 1) Officials were genuinely concerned about the confidentiality of the information that they were asked to discuss;
- 2) Every Ministry was obviously reticent about pressing its views on the Commission. Officials had been warned that the Commission was making an independent survey of the problems and that they should not attempt to sway its decisions;
- 3) Most officials simply lacked experience in appearing before the public.

Easy communication with the public, especially with a large audience, requires considerable practice and is an art that not everyone can acquire even with practice.

The new Planning and Development Act provides for extensive dialogue between the planners of any major project and the public who will be affected by it. Every ministry that is likely to have to take part in this dialogue should begin now to prepare for it. This will first require greatly improved intercommunication and coordination between

the ministries, so that they will each know a good deal about what the others are doing. It will also require some new understandings concerning confidentiality because, if the dialogue with the public is to be effective, it must take place prior to final approval of the development plan by the Provincial Cabinet. This means that government officials must be prepared to discuss freely material that may later form part of their recommendations to Cabinet. To do this effectively, they must have the support and encouragement of their superiors, right up to and including the Cabinet Ministers.

The Commission's experience in communicating with government ministries and in watching them communicate with the public underlines the fact that every ministry that is required by The Planning and Development Act to discuss plans with the public, must give high priority to finding the people and developing the skills needed to do this quickly and effectively. This discussion must not become a series of stilted confrontations guided by counsel in accordance with courtroom procedures; rather, it should be regarded as a task of mutual education and understanding directed toward finding the best solution to very difficult problems with everyone contributing their knowledge to the common pool.

Comments on Proposed Environmental Review Mechanisms

When I was originally appointed as Commissioner, I felt that the primary purpose of the Commission was to examine the environmental impact of Ontario Hydro's proposed "Middle Route" and to advise the Government as to whether the impact was acceptable or not. As the hearings proceeded and I learned more about the problems of land use planning and control, I concluded that it was not possible to separate so-called "environmental problems" from all the other aspects of land use. In seeking to make more effective use of land in a heavily populated area such as southern Ontario, the objective is to so use the land as to create the best possible human environment. Considered in this way, the environment includes not only the trees, fields and streams but also roads, buildings and transmission lines. The so-called "environmentalists" feel that the trees and fields and streams are of such particular importance that they

must be considered separately and that many, if not all, decisions on land use should be based on maximizing the protection of the natural environment. In its extreme this is obviously an untenable position, because it provides no room for man at all. What the environmentalists want, and with this I agree, is to have problems created by the impact of man on the natural environment given careful consideration, in order that human needs for structures like transmission lines can best be accommodated without unnecessary destruction of the natural environment. If this view is accepted, then it follows that a project such as a transmission line cannot be approved or disapproved solely in relation to its effect on the natural environment. Its effect on all sorts of other land uses must be considered simultaneously. This holistic approach to land use control means that all major decisions on land use must be made at the highest available level, in this case the Provincial Cabinet. It also means that the Cabinet must be advised by a competent professional group who have carefully combined and weighed together all the competing factors that are involved in the decision. It is obviously not satisfactory to have the Cabinet supplied with a variety of uncoordinated and possibly conflicting assessments of the use of one piece of land from a variety of different points of view. If this argument is accepted, then it means that any environmental review mechanism that limits itself to the natural environment of trees, fields and streams must supply its input to some other agency that attempts to integrate this concern with all the other factors that must be considered in arriving at intelligent decisions on land use.

The Ministry of the Environment proposes to establish an environmental review mechanism and, in September 1973, issued a Green Paper on Environmental Assessment in order to invite comments on a series of proposals for such a mechanism. If the views that I have outlined above are accepted, then it follows that the environmental review mechanism need not be a separate entity. There could be some organization capable of reviewing any proposed land use from every point of view, including environmental concerns. Unfortunately, no such body yet exists and there is widespread public concern about environmental impact. Consequently it would seem likely that some kind of environmental review board should and

will be established. If this is done, I would strongly recommend that it be viewed as a part of the total mechanism for land use planning and control and not as a separate element with an independent power of veto over proposed land uses.

If an environmental assessment commission is established, care must be taken to ensure that only one series of hearings is held on each major project. Past experience has indicated that successive reviews seriously complicate the issue, lead to sharp divisions in the community and make the ultimate selection of a solution increasingly difficult. This has been clearly demonstrated in the case of the Pickering Airport and less spectacularly but, nonetheless, importantly in the case of the present Commission.

In devising a land use planning and control mechanism, it is important to keep in mind two principles. First, there should not be a stereotyped review procedure that is applied in full to every proposed land use, great or small. The careful procedures that are required, for example, in the siting of a major transmission line are a great waste of time and money if applied to lesser projects. Second, there must be one place in the government where the developer, whether private or public, can deal with one central agency in order to get approval for his project. As I have implied, I do not suggest that this would rule out an independent environmental assessment commission, but it would require that the findings of that commission be integrated with other information in order to present coordinated advice to Cabinet for decision.

Another extremely important function that could be performed by the environmental assessment commission would be progressively to survey the entire province and establish general environmental guidelines for development. For example, about 35% of England and Wales is designated as having special value under a number of categories. This does not mean that transmission lines cannot be built in these areas but only that they require and receive special consideration. Well established guidelines of this kind could greatly reduce the number of difficult cases that come before the assessment commission.

A Data Base for Land Use Planning and Control

When Bhi began to collect the data required for the area study that preceded specific route selection, they found that they had to assemble this information from a wide variety of sources, both provincial and federal. Now that the Ontario Government has embarked on a very courageous and necessary program to introduce much more effective land use planning and control, it would appear to be essential to establish a central data base for all land use planning information. This will require the establishment of a central organization to receive, collate and make available the information. It will be an unpopular move, since each ministry likes to retain its own information and, also, because initially the new organization will add to expenses. However, past experience in similar cases indicates that once the data is centralized and the centralized mechanism is working efficiently, there will be a tremendous reduction in cost and an even more important improvement in the quality of planning. The techniques for maintaining a large part of such a data base in a computer are already evolving and before many years most of the factual information should be almost instantly available from the computer.

I would not presume to make a specific recommendation concerning the organizational location of such a data centre. However, it obviously must be very close to the body that coordinates advice for the Cabinet on land use planning and control. If it is to be fully effective, this data centre obviously must get information from every ministry and must be organized to provide output not only to government agencies but also to the public under suitable conditions.

Appendix A

Ontario Hydro: Recommended Guidelines for the Installation of Improved Appearance Transmission Structures

General

The definition of an improved appearance structure is not entirely clear. For these guidelines it is considered to be any structure that is more visibly compatible with its surroundings than the standard lattice type galvanized steel towers commonly in use throughout the province.

In general, improved appearance structures should be used in areas that are seen frequently by a large number of people or in areas of special historical or scenic interest.

Areas of special concern will normally be defined at the time the route for a new line is selected and approved. In the new route selection procedures now being followed, the final report will indicate the areas of high visible constraint where special structures should be considered.

The type of improved appearance structure used will depend on the nature of the area through which the line passes. It is recognized that in urban and suburban areas, it will not be possible to screen or hide the lines effectively. Therefore, the structure should have simple clean lines with a colour that is compatible with the surroundings. In rural areas with a background of trees, it may be possible to hide or screen the structures effectively by merely painting the lattice towers a dark brown or green.

Examples:

1. Improved appearance structures would be used for new overhead lines within established or definitely planned urban or suburban communities.
2. Improved appearance structures would be used for new overhead lines running parallel to main heavily travelled highways or parkways. Consideration will be given to the use of improved appearance structures at main highway crossings.
3. Improved appearance structures would be used for new overhead lines built through areas of special historical or scenic value, such as across the Niagara Escarpment.
4. Improved appearance structures would not normally be used for new lines built through rural areas.
5. In general, all tower lines on the same section of right-of-way should be of the same general design, e.g. all lattice type or

all improved appearance such as steel pole.

Where existing lines on existing rights-of-way in areas as outlined in (1) - (3) above are to be completely rebuilt within a reasonable length of time, then improved appearance structures should be used.

6. Structures adjacent to new low profile type transformer stations should be of an improved appearance to be compatible with the station.

Appendix B

Solandt Commission Hearings
October 15th, 1973 to December 6th, 1973:
Chronology and Participants

I Queen's Park Hearings

- October 15th Testimony by Bhi Limited on the nature and first three months of their study.
- October 17th Testimony by Bhi on the further months of their study leading to their proposals of alternative routes and the responses to these.
- October 19th Testimony by Bhi on their choice of the recommended route.
- Cross-examination of Bhi by Ontario Hydro, represented by Mr. James B. Southey, Q.C.
- October 22nd Panel of Expert Witnesses on Underground Transmission:
October 23rd
October 24th
 (to noon)
- Mr. A. Sidney Brooks, Consultant, Public Service Gas and Electric Company of New Jersey, U.S.A. ... spoke from long experience in the United States in underground transmission, with particular emphasis on his own utility's experience in the use of high-voltage 'pipe-type' cable.
- Mr. Edward Eich, Principal Engineer, Power Technologies Inc., Schenectady, N.Y., U.S.A. ... described current research on 500 kV pipe cables at the Edison Electric Institute facilities at Waltz Mill, U.S.A. and briefly reviewed possible future technology such as spacer gas, resistive and super-conducting cryogenic systems.
- Mr. Peter Ralston, Senior Transmission Design Engineer, Ontario Hydro, Toronto, Canada ... reviewed Ontario Hydro's present and planned use of SF6 (sulphur-hexafluoride) switch gear and cable.
- Mr. Donald J. Skipper, Cables Engineer, Central Electricity Generating Board of Great Britain, London, England ... spoke on British experience with some 40 circuit kilometers of 400 kV underground transmission, (much of which has been installed for environmental rather than economic reasons), with emphasis on oil-filled and water-cooled cables.
- Mr. Jack H. Waghorne, Director of Research, Ontario Hydro, Toronto, Canada ... spoke on present research

by Ontario Hydro into the DAMUT system (ducted air medium for underground transmission), now being tested at 230 kV.

Mr. R. Patrick Watson, Secretary, Wayleaves (Rights-of-way) Branch, Central Electricity Generating Board of Great Britain, London, England ... spoke of the C.E.G.B.'s environmental experience and practices in the use of underground transmission for the protection of visual amenity.

October 24th Continuation of cross-examination of Bhi by Mr. J.B. Southey, Q.C., counsel for Ontario Hydro, and then by Mr. D. Steele, Q.C., counsel for the Ontario Municipal Electric Association.

Mr. D. Steele, Q.C.	- Ontario Municipal Electric Association
Messrs. R. Day & D. Gordon	- Municipality of Central Halton
Mr. P. Chester	- East Flamborough Area Citizens Committee
Mr. T.O. Fraser, Q.C.	- Town of Vaughan
Mr. G. Kidd	- Halton Federation of Agriculture
Mr. J. Schneider	- Interested Citizens of North Halton and Wellington
Dr. J. Betak	- Kilbride Area Citizens Committee
Mr. R. Seyffert	- Mr. G. Creber

November 5th Completion of cross-examination of Bhi, by:

Mr. R. Seyffert	- Mr. G. Creber
Mayor B. Best	- Town of Milton
Mr. G. Yates, Q.C.	- County of Wentworth
Mr. G. Cooper	- Sierra Club of Ontario
Mr. R.J. Watson, Q.C.	- Mr. J. Gilbert
Mr. G. Meek	

On completion of cross-examination, the presentation of oral submissions began:

Messrs. R. Day & D. Gordon	- The Municipality of Central Halton
Mr. L.R. Symmes	- The Coalition of Concerned Citizens
Messrs. G. Kidd & H. Middlebrook	- Halton Federation of Agriculture

November 7th Panel of Expert Witnesses on the Impact of Transmission lines on the Beverly Swamp:

Mr. Robert Burdett, Strategic Planning Branch, Ontario Ministry of the Environment ... presented views on

the preservation of the Beverly Swamp, within the context of planning for the Toronto-Centred Region.

Mr. David Cressman, Line Construction Branch, Ontario Hydro ... spoke on Ontario Hydro's revised and special construction practices, proposed for traversing the swamp with minimum impact.

Mr. Raymond Dickie, Conservation Authorities Branch, Ontario Ministry of Natural Resources ... spoke on the importance of detailed conservation studies of the swamp.

Mr. Raymond Freeman, Forestry Branch, Ontario Hydro ... presented evidence on Ontario Hydro's research into the ecology of the swamp and ecological practices to be followed in any routing of a transmission line through it.

Mr. Roy Gilbert, Cambridge District Office, Ontario Ministry of Natural Resources ... spoke of present conditions of plant and animal life within the swamp, and the possible effects on these of a transmission line.

Mr. Robert Maestro, ecological consultant to Bhi ... reviewed the possible injurious effects on the swamp of a transmission line.

Dr. Norman Radforth, ecological consultant to Ontario Hydro and a specialist in the mechanics and botany of muskeg terrain ... presented evidence on the ecology of the swamp, suggesting that present information was sufficient to predicate a crossing without lasting impact, but which would require detailed implementation studies.

Dr. John Sparling, ecological consultant to Bhi ... also reviewed the potentially injurious impact of a transmission line, with emphasis on the swamp's hydrological and botanical systems.

Mr. Ben Vanderbrug, Hamilton Region Conservation Authority ... reviewed the Authority's activities in the preservation of the swamp, emphasizing the need of detailed studies relative to any possible transmission line crossing.

November 9th Continuation of presentation of oral submissions:

Mr. D. Moskal	- Town of Burlington
Mr. N. Vollick	- County of Wentworth
Dr. E. Davison	- Arkell Area Citizens
Mr. P. Chester	- East Flamborough Area Citizens Committee
Mr. B. Coates	- Halton Region Conservation Authority

Mr. R. Gardhouse
Mr. R. Southward & - Kilbride Area Citizens
Dr. J. Betak Committee
Mr. J. McColl
Mr. M.H. McPhail - No. 7 Farms Ltd.
Mr. G. Meek

November 12th Continuation of presentation of oral submissions:

Mr. T. Moore - Flamoro Hills Citizens
Committee
Messrs G. Cooper - Sierra Club of Ontario
& B. King
Mr. M. Bailey - Ontario Federation of
Agriculture
Mr. J.D. Watson - Nassagaweya Township,
Dr. V. Parks & Mr. B. Hall
Mr. J. Hourigan, Q.C. - Dr. C.C. Hopmans
Mr. R. Willis - Pickering Township
Mr. J.F. Hopkins - East Gwillimbury Township

November 14th Continuation of presentation of oral submissions:

Mr. P. Hannam - Wellington County Federation
of Agriculture
Mr. R. Shiff, Q.C. - Demro/D.B.F. Holdings
Mr. R.J. Watson, Q.C. - Mr. J. Gilbert
Mr. J.A. Taylor, Q.C. - Town of Markham
Mr. B. Penman
Mr. D. Ritchie - Cedar Grove Community Club
Mr. R. Seyffert - Mr. G. Creber
Mr. R. Robertson, Q.C. - Algonquin Building Credits Ltd.
Mr. R.L. Duke
Mrs. S. Symmes - Township of Esquesing
Mr. R. Rimon - Town of Richmond Hill

November 15th Continuation of presentation of oral submissions:

Mr. T.O. Fraser, Q.C. - Town of Vaughan
Mr. J. Schneider - Interested Citizens of North
Halton and Wellington
Mr. L. Hennesey - Concerned Citizens: Newmarket
to Gormley
Mr. L. May, Q.C. - Dino Investments Ltd.
Mr. D. Steele, Q.C. - Ontario Municipal Electric
Association
Mr. W. Matthews - Thornhill-Vaughan Residents
Association

Ontario Hydro then began presentation of their evidence:

Mr. D. Westwood - Improved Appearance Towers
Transmission and

Distribution Pro-
jects Engineer

Mr. J. Waghorne - Compact Towers
Director of
Research

Mr. L. Gordon - SF6 (sulphur-hexafluoride)
Basic Design and switch gear
Development Engineer

November 19th Continuation of testimony by Ontario Hydro:

Mr. K.R. McClymont - Comparative Statistics on
Manager, Trans- Population and Load (Ontario,
mission System U.K., U.S.A.)
Planning

- Cost comparison of alternative
routes, Middleport to Pickering

- Systems security, in relation
to "System R"

November 23rd Panel of Expert Witnesses on the Impact of Transmission
Lines on Agriculture:

Mr. Mason Bailey, representing the Ontario Federation
of Agriculture ... has both farmed and been involved
in farm real estate for a number of years, and offered
the views of the practicing farmer.

Professor Thomas Lane, Department of Land Resource
Sciences, University of Guelph, Guelph, Ontario ...
has had lengthy, continuing contact with the agricultural
community in his work in the soil sciences and management
field.

Mr. Harold Middlebrook, representing the Halton County
Federation of Agriculture ... as a farmer and Director
of the Ontario Federation of Agriculture, offered the
views of the practicing farmer.

Mr. Douglas H. Miles, Area Coordinator and Farm Management
Specialist, Ontario Ministry of Agriculture and Food
... presented views based on many years experience, as
a Ministry advisor, in the problems of day-to-day farm
management.

Mr. Peter Ralston, Senior Transmission Design Engineer,
Ontario Hydro ... provided information in the area of
transmission technology and electrical effects, relative
to agriculture.

Professor Stephen Rodd, School of Agricultural Economics, University of Guelph, Guelph, Ontario ... spoke from a background in regional economics and research in agricultural planning and development.

Continuation of testimony by Ontario Hydro:

Mr. N.J. McMurtrie, - Property policies and practices
Director, Property
Division

November 28th Panel of Expert Witnesses on Meteorology:

Mr. Donald K.A. Gillies, Senior Meteorologist, Ontario Hydro, Toronto ... provided material and historical evidence on the effects of weather conditions on transmission lines and towers.

Mr. George A. McKay, Chief Meteorologist, Atmospheric Environmental Services Branch, Ministry of the Environment, Government of Canada, Toronto, ... provided information in the form of historical records and statistical forecasts, as to the incidence of tornados, severe winds and ice storms in the area north-west of Toronto.

Continuation of testimony by Ontario Hydro:

Mr. K.R. McClymont - Systems and systems
security

November 30th Interministerial Government Panel:

Mr. R.M. Dillon, Deputy Minister, Ontario Ministry of Energy, (Chairman)

Mr. D. Birnbaum, Senior Environmental Planner, Strategic Planning Branch, Ontario Ministry of the Environment

Mr. S.J. Clasky, Coordinator, Policy and Research, Ontario Ministry of Treasury, Economics & Intergovernmental Affairs

Mr. I. Fraser, Senior Regional Planner, Regional Planning Branch, Ontario Ministry of Treasury, Economics & Intergovernmental Affairs

Mr. A. Garfin, Chairman, Parkway Belt Task Force, Ontario Ministry of Treasury, Economics & Intergovernmental Affairs

Mr. N.J. McMurtrie, Director, Property Division, Ontario Hydro

Mr. F. Norman, Chief Feasibility Planner, Environmental and Feasibility Studies Office, Ontario Ministry of Transportation and Communications

Mr. R. Vrancart, Lands Coordinator, Ontario Ministry of Natural Resources

December 5th Continuation of testimony by Ontario Hydro:

Mr. K. McClymont - The Limehouse crossing of the
Niagara Escarpment

Cross-examination of Ontario Hydro on systems and route alternatives

December 6th Continuation of cross-examination of Ontario Hydro on systems and route alternatives:

Mr. J.H. Murchison - Visual impact of transmission
Landscape Architect, lines and towers
Forestry Section

Mr. R.C. Black - Road-salt contamination and
Senior Project line maintenance
Engineer, Line
Maintenance Department

Dr. R.E. Walker - Presentation of possible
Senior Ecologist, corridors in the "Bradley
System Maintenance Junction to Georgetown"
Department transmission line study area,
in relation to the Middleport
to Pickering study area

Submission by:

Mr. H. Karal, Q.C. - Caledon Ratepayers' Association

Concluding remarks, Dr. O.M. Solandt, Commissioner

- 73-A-15 Memorandum, 26/11/73, re: H.V. Transmission Rights-of-Way, Asset Values, from Mr. S.A.J. Fraser to Mr. K.R. McClymont
- 73-A-16 Evidence for the Solandt Commission on Urgency of 500 kV Lines
- 73-A-17 System Planning, 27/11/73, DWG.D.15509S-P to DWG.D.15512S-P
- 73-A-18 Typical Annual Costs, 500 kV Line and Right-of-Way
- 73-A-19 Environmental Criteria for Electric Transmission Systems, United States Department of the Interior
- 73-A-20 Schedule for the Incorporation of Bruce Generating Station
- 73-A-21 Information relating to the Supply of Steel Poles, 22/11/73
- 73-A-22 Information relating to SF6 Switch Gear, 26/11/73, requested by Mr. G.L. Symmes
- 73-A-23 Statement of Ontario Hydro regarding Bhi Environmental Study
- 73-A-24 Curriculum vitae, Dr. R. E. Walker
- 73-A-25 Bradley-Georgetown Transmission Line Study Alternative Corridors
- 73-A-26 Preliminary Comparison of Best Routings for Various Schemes to Transmit Power Between Kitchener TS & Bhi's alternatives
- 73-A-27 1 large aerial photo and 7 small mock-up photos showing towers at 401 Corridor (73-A-27 a-h)
- 73-A-28 Critical Path Schedule, Parts 1-6
- 73-A-29 Hearings of Necessity-Expropriations Act, and Letter of 13/12/73, from Mr. N. McMurtrie to Dr. O.M. Solandt, regarding Critical Path Schedule, Parts 6-53
- 73-A-30 Hydro Submission on Evidence, 21/12/73

73-B Ontario Government/Federal Government

73-B-1 Ministry of Agriculture & Food

73-B-2 Atmospheric Environment Services, Government of Canada

73-B-3 Ministry of Community & Social Services

73-B-4 Ministry of Consumer & Commercial Relations

73-B-5 Ministry of Energy

73-B-6 Ministry of the Environment

73-B-7 Ministry of Treasury, Economics & Intergovernmental Affairs

73-B-8 Ministry of Transportation & Communications

73-C Bhi Limited

- 73-C-1 An Environmental Study to Select Hydro Transmission Corridors for the Solandt Commission
- 73-C-2 An Abstract: An Environmental Study to Select Hydro Transmission Corridors for the Solandt Commission
- 73-C-3 Report to Bhi of Citizens' Subcommittee on Tower Design
- 73-C-4 Report to Bhi of Citizens' Subcommittee on Substation Design
- 73-C-5 Memorandum, 26/3/73, to Bhi from Mr. A.H. Anderson, Ontario Hydro
- 73-C-6 Research on Compact Transmission Lines in Ontario - Mr. J.G. Cassan and Mr. O. Nigol, 28/8/73
- 73-C-7 Letter, 29/8/73 to Bhi from Mr. J.B. Smith, Ontario Hydro
- 73-C-8 "Hydro News", July/August 1973 edition (Ref. p. 18-21)
- 73-C-9 An Ecological Study of the Proposed Hydro Alignment through the Beverly Swamp, by Mr. R.M. Maestro, ecological consultant to Bhi
- 73-C-10 Letter, 26/7/73, from Mr. K. McClymont, Ontario Hydro, to Mr. B. Howlett, regarding Ontario Hydro's security requirements
- 73-C-11 Bhi memorandum to the Solandt Commission, 2/11/73, Errata: Oakville-Mississauga Minibelt Connection to Halton Substation
- 73-C-12 Bhi Submission to the Solandt Commission, regarding acreage of agricultural land affected by Bhi route proposals

73-D Municipal Governments

- 73-D-1 Town of Burlington Planning Board, Resolution 69, 1973
- 73-D-2 Town of Burlington: Land Use Map and accompanying 35 mm slides
- 73-D-3 Town of Burlington: Map of Soil Capability for Agriculture
- 73-D-4 Town of Burlington: Map of Proposed Land Use, Rural Areas
- 73-D-5 Township of Albion
- 73-D-6 Township of Ancaster
- 73-D-7 Town of Brampton
- 73-D-8 Town of Burlington
- 73-D-9 Central Halton
- 73-D-10 Central Ontario Joint Planning Board
- 73-D-11 Township of Chinguacousy
- 73-D-12 Township of East Gwillimbury
- 73-D-13 Municipality of Erin Township
- 73-D-14 Township of Esquesing
- 73-D-15 Georgetown Planning Board
- 73-D-16 City of Guelph
- 73-D-17 County of Halton
- 73-D-18 Township of King
- 73-D-19 Town of Markham
- 73-D-20 Municipality of Metropolitan Toronto
- 73-D-21 Town of Milton
- 73-D-22 Town of Mississauga
- 73-D-23 Peel Board of Education
- 73-D-24 Township of Pickering
- 73-D-25 Township of Puslinch
- 73-D-26 Town of Richmond Hill

- 73-D-27 Borough of Scarborough
- 73-D-28 County of Wentworth
- 73-D-29 Town of Whitchurch-Stouffville
- 73-D-30 Township of Toronto Gore
- 73-D-31 Town of Vaughan
- 73-D-32 Regional Municipality of York
- 73-D-33 Town of Newmarket

73-E Groups and Associations

- 73-E-1 Wellington Federation of Agriculture
- 73-E-2 Albion Property Association
- 73-E-3 Algonquin Building Credits Ltd.
- 73-E-4 Arkell Area Residents
- 73-E-5 Bruce Trail Association
- 73-E-6 Caledon Citizens' Group
- 73-E-7 Cedar Grove Committee Club Inc.
- 73-E-8 Coalition of Concerned Citizens
- 73-E-9 Concerned Citizens of King Township
- 73-E-10 Conservation Council of Ontario
- 73-E-11 Esquesing Citizens' Group
- 73-E-12 Federation of Ontario Naturalists
- 73-E-13 Flamborough East Area Citizens' Committee
- 73-E-14 Flamborough Hills Citizens' Committee
- 73-E-15 Georgetown and District Naturalists Club
- 73-E-16 Grand River Conservation Authority
- 73-E-17 Halton Federation of Agriculture
- 73-E-18 Halton Region Conservation Authority
- 73-E-19 Hillside Community Association
- 73-E-20 Kilbride and District Area Citizens
- 73-E-21 Mayfield Land Owners Group
- 73-E-22 Committee of Concerned Property Owners, Newmarket to Gormley
- 73-E-23 Ontario Federation of Agriculture
- 73-E-24 The Ontario Milk Marketing Board
- 73-E-25 Ontario Municipal Electric Association
- 73-E-26 Peel County Federation of Agriculture

- 73-E-27 Sierra Club of Ontario
- 73-E-28 Interested Citizens of North Halton and Wellington
- 73-E-29 Speyside Area Ratepayers' Association
- 73-E-30 Thornhill-Vaughan Residents' Association
- 73-E-31 Wellington County Federation of Agriculture
- 73-E-32 Credit Valley Conservation Authority

73-F Individuals

- 73-F-1 Ontario Department of Highways - Proposed Highway Plan,
 (P-5024-7) re Highway 404, 13/10/61, submitted by Mr. R. Seyffert,
 counsel, on behalf of Mr. G. Creber
- 73-F-2 Ontario Department of Highways - Proposed Highway Plan,
 (P-5024-1) re Highway 404, 7/5/62, submitted by Mr. R. Seyffert,
 counsel, on behalf of Mr. G. Creber
- 73-F-3 Proposed Plan of Subdivision for Demro Holdings Ltd.,
 (Riverbank Glen)(June, 1973)
- 73-F-4 Proposed Plan of Subdivision for Demro Holdings Ltd.,
 (Riverbank Glen), showing proposed detailed planning and
 construction
- 73-F-5 Proposed Plan of Subdivision for Demro Holdings Ltd.,
 (Riverbank Glen), showing location of proposed Parkway Belt
 and 500 kV right-of-way
- 73-F-6 List of Owners of Properties, Town of Vaughan, represented
 by Mr. L. May. Q.C.
- 73-F-7 Map of Town of Vaughan, indicating properties of owners listed
 in Exhibit 73-F-6
- 73-F-8 Composite Zone Map, Town of Vaughan, filed by Mr. L. May, Q.C.
- 73-F-9 Mrs. R. Anderson
- 73-F-10 J. Baine & M. Baine
- 73-F-11 Mr. & Mrs. C.J. Barnes
- 73-F-12 L. Belluz
- 73-F-13 R. J. Boville
- 73-F-14 Wm. C. Bowles
- 73-F-15 Mrs. F.A. Boulton
- 73-F-16 G. Brender à Brandis
- 73-F-17 Dr. A.D. Brewer
- 73-F-18 Dr. B.A. Brown
- 73-F-19 Burlington Public Utilities
- 73-F-20 C.F.W. Burns

73-F-21 A.G. Burton
73-F-22 R.J. Cartwright
73-F-23 Chudleigh's Pick-Your-Own-Farm
73-F-24 G. Clement & M. Clement
73-F-25 G.A. Collins
73-F-26 J. Cooke Real Estate Ltd.
73-F-27 P.A. Crawford
73-F-28 G.E. Creber
73-F-29 D.B.F. Holding Ltd.
73-F-30 Dr. F.A. Dahms
73-F-31 W.I. Davidson
73-F-32 B.G. Day
73-F-33 Demro Holdings Ltd.
73-F-34 D. Denny
73-F-35 Dino Investments Ltd.
73-F-36 A.G. Dolcitti
73-F-37 C.K. Duff
73-F-38 D.W. Duke
73-F-39 R.L. Duke
73-F-40 J.M. Eaton
73-F-41 Eaton's of Canada Ltd.
73-F-42 Everest & Jennings Canadian Ltd.
73-F-43 D. Ewen, M.P.P.
73-F-44 J.F. Filby
73-F-45 T.C. Foster
73-F-46 R.W. Gardhouse
73-F-47 J.C. Gilbert

73-F-48 Glen Ash Developments
73-F-49 A. Green
73-F-50 R. Gulliver
73-F-51 R.G. Hadfield
73-F-52 B.R.B. Hall
73-F-53 F. Hampshire
73-F-54 B.J. Henderson
73-F-55 Mr. & Mrs. P.R. Hicks
73-F-56 C. Hildebrandt
73-F-57 J.W. Hill
73-F-58 Dr. C.C. Hopmans
73-F-59 O.T. Hunt
73-F-60 Islay Farm Fly Fishermen
73-F-61 Wm. F. James
73-F-62 F.R. Joubin
73-F-63 J. Kool & C. Kool
73-F-64 Mr. & Mrs. D. Kraftcheck
73-F-65 R. Lawrence
73-F-66 L. Dixon & L. Dixon
73-F-67 M. Lazarczyk
73-F-68 R. Leonard
73-F-69 H. Lue-Kim
73-F-70 H. MacCallum & R.B. MacCallum
73-F-71 M. MacDonald
73-F-72 I. MacIntosh
73-F-73 A. Marrese & L. Marrese
73-F-74 J.B. McColl

73-F-75 J.J. McEntee
73-F-76 W.F. McMackon
73-F-77 C.E. McNinch
73-F-78 Meadowvale (Markborough Property Ltd.)
73-F-79 G. Meek
73-F-80 T. Moore
73-F-81 F.B. Munroe
73-F-82 C.H. Newby
73-F-83 J. Newell
73-F-84 G. Niederlinski
73-F-85 N.H.D. Developments
73-F-86 No. 7 Farms Ltd.
73-F-87 Withdrawn
73-F-88 Oakville Public Utilities
73-F-89 A.R. Oliver
73-F-90 The Ontario Jockey Club
73-F-91 Ontario Motor Coach Association
73-F-92 J.D. Ord
73-F-93 Dr. V.J. Parks
73-F-94 Parkway Hotels
73-F-95 B.C. Penman
73-F-96 Mrs. J.M. Ralph
73-F-97 Mr. & Mrs. C. Ray
73-F-98 Resort Hotels Ltd.
73-F-99 N. Rutherford & P. Rutherford
73-F-100 E.D. Scott
73-F-101 G. Sill
73-F-102 Charles E. Simmon & Associates Ltd.

73-F-103 Mr. & Mrs. N. Staskovich
73-F-104 D.A. Stevenson
73-F-105 Mrs. I. Stevenson
73-F-106 Mr. & Mrs. D.A. Taylor
73-F-107 B.G. Thomas
73-F-108 J.E. Todd
73-F-109 Mr. & Mrs. D. Trevisani
73-F-110 B.W. Vanderbrug
73-F-111 Dr. G.F. West
73-F-112 R. Widmaier
73-F-113 W.L. Wilkinson
73-F-114 R.F. Young
73-F-115 L.A. May
73-F-116 C.E. Dickman
73-F-117 E.A. Fuller
73-F-118 C.G. Hill
73-F-119 Mrs. J.M. Innis
73-F-120 P. Lemay
73-F-121 H. Sayer
73-F-122 L. Steele
73-F-123 I. Switzer
73-F-124 Mrs. D. Bell
73-F-125 J.D. Wood
73-F-126 J.M. Glassco
73-F-127 G. McDiarmid
73-F-128 J.L. Ladell
73-F-129 B. Marler

73-F-130 R. Stuart

73-F-131 M.A. Harrison

73-F-132 S. Miles

73-F-133 F.W. Beales

73-F-134 Mrs. R.B. Robinson

73-F-135 A.T. Wicks

73-G Miscellaneous

73-G-1 Survey of Beverly Swamp, as part of the International Biological Programme, completed by Mr. I.D. Macdonald, 18/2/72. Filed by Mr. R. Maestro, ecological consultant to Bhi.

73-G-2 Portions, relating to Beverly Swamp, of 1960 Conservation Authority Report on Spencer Creek. Filed by Mr. R. Maestro, ecological consultant to Bhi.

73-H Solandt Commission

73-H-1 Ontario Hydro: Recommended Guidelines for the Installation of Improved Appearance Transmission Structures

73-H-2 Some Weather Hazards Affecting Transmission Line Design, by G.A. McKay

73-H-3 Journal of Applied Meteorology, December 1969

